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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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HISTORY OF THE FISH AND FISHING CONDITIONS OF LAKE TAHOE

By W. H. SHEBLEY, In Charge Bureau of Fish Culture.

There has been considerable agitation during the last few years by the resort owners and a certain class of anglers that fishing conditions in Lake Tahoe are not as good as in former years and that something should be done to improve the conditions of fishing in this lake, particularly by the Division of Fish and Game.

Present conditions of Lake Tahoe are the result of a long chain of causes and effects. To have an adequate understanding of them, it is

necessary to review the events that have occurred in the past and the changes that have taken place since the advent of the first comers to the lake.

Lake Tahoe, or Lake Bigler, as it was first named, was discovered by General John C. Fremont in 1849. The first white men to explore

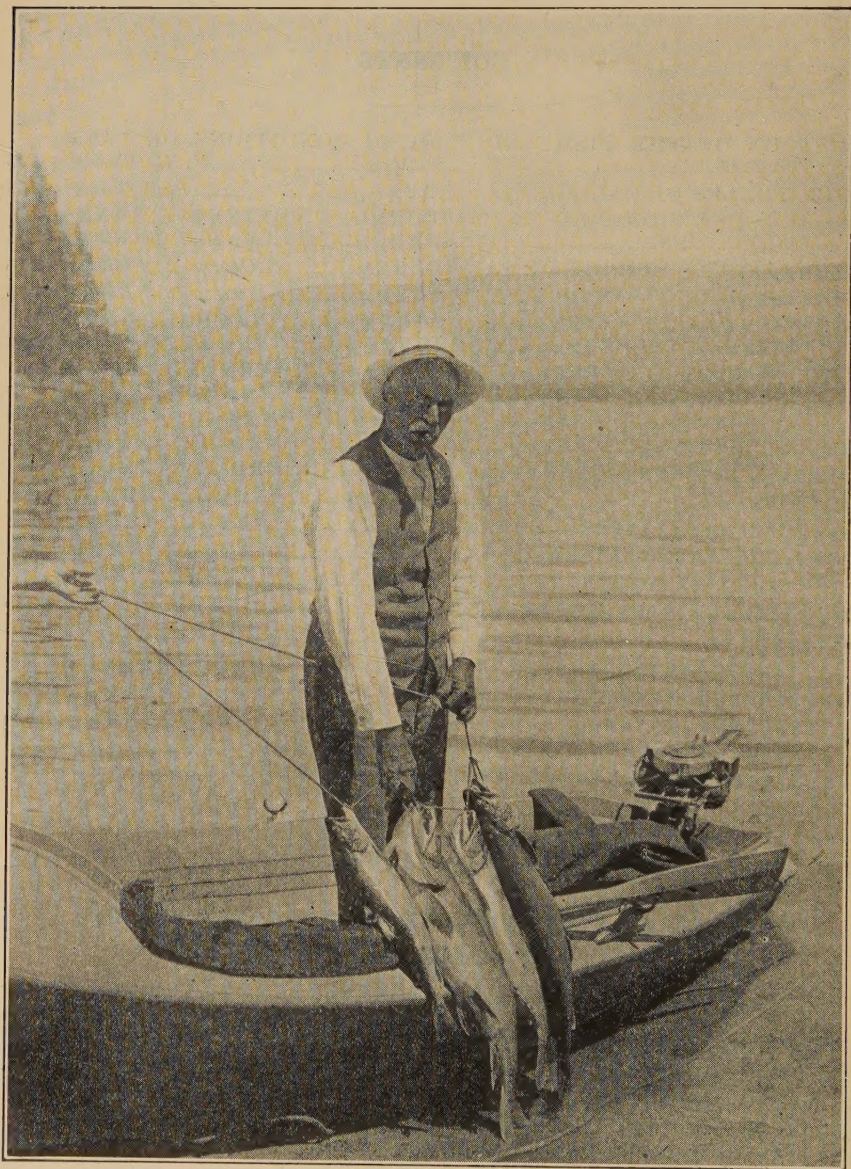


FIG. 55. Splendid catches of trout are still to be made in the deeper parts of Lake Tahoe during the summer months. Photograph taken in Meeks Bay by John Work, July 24, 1926.

around Lake Tahoe found it one of the most prolific of fish life of any body of water within the confines of the United States.

The area of the lake is 193 square miles. Its altitude (lake surface) during seasons of normal snow and rainfall is 6225 feet. It is the largest body of fresh water in the United States at such an altitude. Approximately three-fourths of the lake is in California and one-fourth in Nevada. There are 27 tributary streams flowing into it. In past years these streams furnished spawning grounds for the trout of Lake Tahoe. They ascended these tributary streams during the spawning season from March to August by countless thousands.

The outlet of Lake Tahoe is the Truckee River which empties into Pyramid Lake in Nevada. The same species of trout are found in Pyramid Lake as in Lake Tahoe. Before conditions were changed the run of trout during the spring months when the spawning season was on from Pyramid Lake and Mud Lake up the Truckee River, and as far as Lake Tahoe was beyond computation. Trout actually went up in the hundreds of thousands. They ascended even into Donner Lake, Donner Creek and entered the Little Truckee River and other tributary streams of the main Truckee.

With the opening of the Virginia City mines and the construction of the Central Pacific Railroad through this country, the streams were trapped. Market fishermen, both Indians and whites, operated on the lake and on its tributaries and took out hundreds of tons of valuable trout each year. Most of the trout taken were used in the construction camps of the Central Pacific Railroad Company and in the mining camps at Virginia City, Gold Hill and other places in Nevada. Some were shipped to San Francisco. After the opening of the railroad, shipments were made to all places where the fish could be delivered before spoiling. There were no means of control and operations were carried on without hindrance from anyone. There was no patrol system and when one was established, no one could be convicted. Fishing was continued throughout the year.

Permanent traps were constructed on the principal streams, such as Meeks Creek, Phipps Creek, McKinneys Creek, Blackwood Creek, Ward Creek, and in fact, wherever the traps could be easily installed. In some instances, the entire run was taken and shipped to the markets. In other cases, the run was used as food in the lumber camps that opened up around the shores of the lake. The fish were not only taken by traps, but by gill nets and seines and every other known device. By 1888, the abundant supply was exhausted and signs of depletion were not far off.

The sawmill owners built dams near Verdi, Nevada, and up to the outlet of Lake Tahoe in order to hold back the water to float the logs to the mills. These dams effectively broke up the run of fish that ascended the Truckee River to Lake Tahoe. The mills dumped all the slabs, saw dust, shavings and every sort of mill refuse into the Truckee River until an immense bar was formed at the mouth of the Truckee River. Composed of sawdust, this extended into Pyramid Lake for a mile or more and at a depth of several hundred feet. This destroyed the great run of fish in Lake Tahoe. The only streams that kept up the supply and prevented the entire lake from becoming depleted of its fish life were the tributary streams.

Early efforts of the Fish and Game Commission to restore the depleted waters of Lake Tahoe were futile. There was neither money for extensive hatchery operations nor for warden service. A small hatchery was constructed in 1880 by John Hurley under a permit from the commission. The hatchery was supervised by I. C. Frazier, at that time one of the leading fish-culturists of California. The small number of eggs that were collected and hatched, however, were ineffectual in restoring the depleted run.

In 1889, the commission managed to get an appropriation of \$5,000 a year from the legislature for fish cultural purposes. The commission decided to erect a hatchery and to see if they could possibly restore the run of fish in Lake Tahoe. This sum was not set aside for the specific purpose of propagating fish for Lake Tahoe, but for the entire State of California.

The Mt. Shasta Hatchery, then known as the Sisson Hatchery, had been completed the year before. Other hatchery work had to be carried on. The commission was busy introducing foreign species of fishes. Nevertheless, the commission concentrated its efforts, however feeble, at Lake Tahoe. The work was under the able supervision of John G. Woodbury, then superintendent of hatcheries who spent his money and time to carry it on. The writer, then an apprentice fish-culturist, with the assistance of E. W. Hunt, recently deceased, assisted in this work.

While the commission was making this effort to establish a hatchery, and restore the greatly depleted number of fish in Lake Tahoe, as well as to stock the barren lakes located in the glacial basins in the higher ranges to the west and southwest of the lake, the resort keepers, market fishermen and others, resisted as far as they possibly could. The lives of those who were engaged in the work were even threatened.

It was an almost hopeless task to do anything with the Truckee River. The sawmills had the river completely blocked with their dams and mill ponds. Nearly all the fish that came up from Pyramid Lake to deposit their eggs were destroyed by sawdust, slabs and the like. So great was this pollution of the river that the writer, as a boy, in the early eighties, saw the Truckee River in the summer months, practically colored white by the immense amount of sawdust coming down from the large mills operating on the river. He saw the remaining trout trying to force their way up through this deleterious mass almost as thick as mush. Very few survived and soon none could be seen except now and then in some little tributary stream of the Truckee River.

In 1883, a hatchery was established in Nevada County near the town of Grass Valley. This was on the line of the Nevada County Narrow Gauge Railway on the property of J. V. Shebley, one of the early fish-culturists of this state. He had a pond system on his farm which the Board of Fish and Game Commissioners thought was a suitable and desirable place to operate a small hatchery. Funds had been so limited and, as there was plenty of fish in other lakes and streams, particularly in the head waters where there was very little mining, very little real effort had been made to restore that which the pioneers had destroyed. This operation, therefore, marks the beginning to stock some of the depleted waters of the foothill streams that had been destroyed by mining debris. The pioneers had been after gold and cared not whether any fish survived or not.

James A. Richardson, an employee of the commission, was sent to Lake Tahoe early in June, 1883, to collect a number of black-spotted trout eggs. The plan was to hatch these eggs and the resulting fry were to be returned to Lake Tahoe, Donner Lake and other lakes that at that time were particularly in need of restocking. Richardson operated traps at Meeks Creek, Phipps Creek and in Incline Creek in Nevada state by a permit issued by General Carey, then Nevada fish commissioner, and the result of his season's operations produced not to exceed 250,000 eggs. This insignificant yield is an illustration of conditions in Lake Tahoe when the commission started its first work of restocking.

The great balance of nature had been destroyed. It is well known by biologists that when a balance of nature is once established in a river

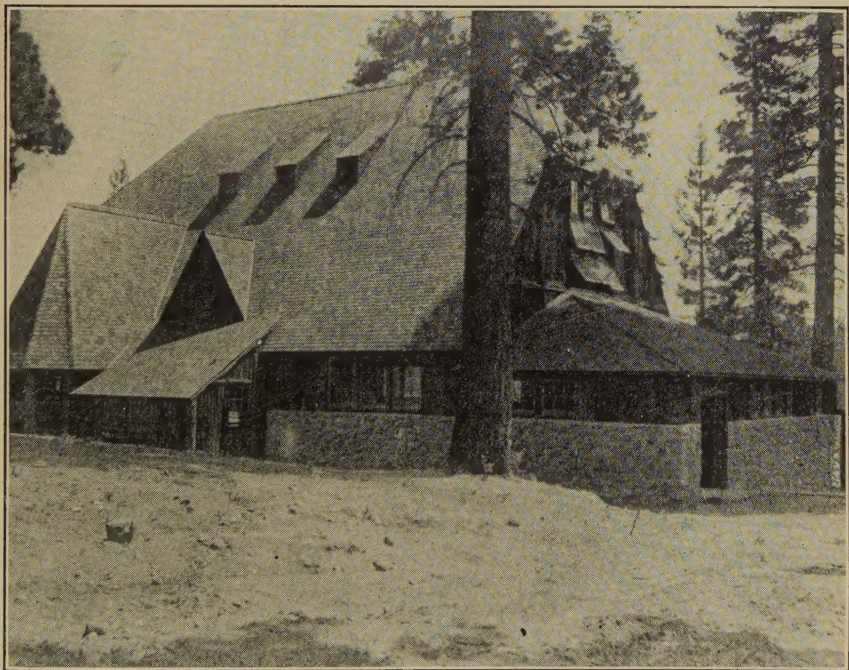


FIG. 56. Tahoe Hatchery, near Tahoe City, Placer County. Photograph by M. K. Spaulding, August, 1920.

or lake, nature produces practically the same amount of food, aquatic plants and fishes each year. Otherwise, if there was a gradual increase of different life forms, at the expense of the rest, one species would soon predominate to the detriment of the others. When the balance of nature was established in Lake Tahoe ages ago, there was not in general more fish one season than in another. In other words, each pair of adult fish or mature spawners produced at the end of the life cycle, only one more pair to succeed them. All the others were removed by predatory animals or birds, and by their own kind, for trout are by nature cannibalistic.

When civilized man began his destructive methods and disturbed the balance, artificial means were necessary to offset the loss. In the state

of nature probably not over 3 to 5 per cent of the eggs are fertilized. Those eggs that become fertilized and hatch into living embryos and develop into fish are destroyed to the extent that by the time maturity is reached there is but one pair resulting from each pair as progenitors. Through the artificial process, 80 to 90 per cent of the eggs are fertilized, and the resulting young reared to suitable size. Because of this, the

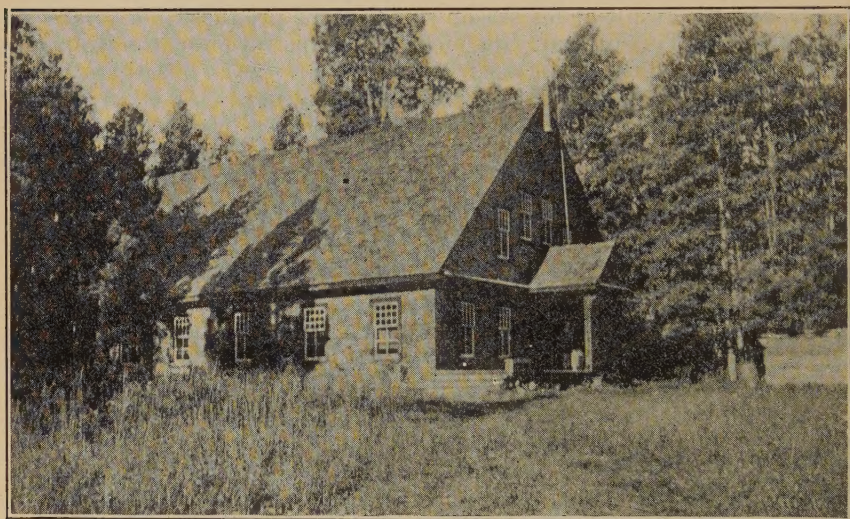


FIG. 57. Tallac Hatchery, at the mouth of Taylor Creek, near Tallac, El Dorado County.

artificial process multiplies the fishes many fold. If the hatcheries are properly handled, the eggs and fry kept free from disease and the fish properly planted, the balance of nature can be restored so that a great many fish can be taken from the run each year for human consumption and still enough remain to furnish the spawners for future generations. The greatest loss among artificially raised fish is caused by diseases. Where healthy fish are planted, they will certainly develop and produce adult fish. Fish culture, or aqua culture as called by some, is just as scientific a piece of food producing work as agriculture, or other means used by man in producing food and maintaining conditions so that the human family will have food enough to subsist on.

In 1889, when the Fish Commission started operations in the old Tahoe Hatchery, just north of Tahoe City, it faced a very discouraging problem. The chief obstacles were the market fishermen and others who persisted in the destruction of fish life in the Truckee River and the tributary streams of Lake Tahoe. For several years a continuous war was waged but without any results. The local courts were influenced by local sentiment and by owners of saw mills. They desired to stand in with the majority of the people, who, regardless of whether there would be any fish for the coming generations, cared not how many fish were destroyed as long as they themselves could reap the benefit. It was cheaper to dump the sawdust into the river than to burn it. It was easier for the market fishermen to catch the fish off the

spawning beds when the fish were trying to propagate. Since their whole energies are devoted to producing and fertilizing their eggs, fishes care not who approaches them at that time for their spawning instinct predominates over all other senses. They fall an easy prey to their natural enemies and particularly to man, who can easily spear, snag or trap them.

In the long struggle which ensued, the commission and its agents were criticized, threatened and charged with all kinds of misdemeanors. It was not until 1897 that the Fish Commission, through Attorney General W. F. Fitzgerald, succeeded in getting an injunction from the superior court of Nevada County to enjoin the Truckee River Lumber Company from dumping debris in the Truckee River. This decision was appealed to the Supreme Court of the state. In a decision rendered by Judge Van Fleet, the restraining order of the superior court of Nevada County was upheld and the milling interests were compelled to dispose of their refuse matter, sawdust, shavings, edgings

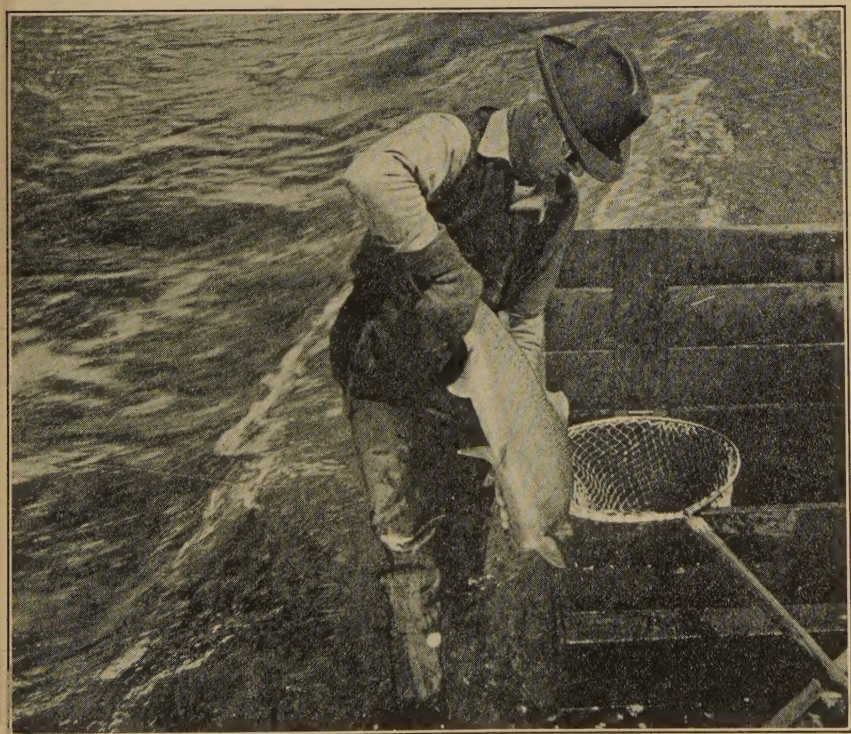


FIG. 58. Taking spawn from a ten-pound Tahoe black-spotted trout. Taylor Creek, El Dorado County. Photograph by Joseph H. Sanders, May 1, 1922.

and other mill waste and deleterious substances in some other way than passing it into the waters of the Truckee River. This was the first real victory in the battle to save the fish in Lake Tahoe and Truckee River.

Prior to this, the upper reaches of Truckee River had been stocked with a few rainbow trout that had been hatched at the I. C. Frazier

Hatchery under the supervision of the commission. These were planted above the worst of the polluted area and where a few of these fish could be found.

In the fall of 1889, the commission built the Tahoe Hatchery and began operations to increase the fish in Lake Tahoe by hatching as many eggs as possible. This was just after a year of great drought, 1889 being one of the driest seasons in the history of the state prior to the summer of 1924. In October, 1889, the water practically ceased running out of Lake Tahoe. All the water in the Truckee River had collected in small pools and percolated through the gravel from pool to pool. During the winter of 1889 and 1890, one of the deepest snows of many years fell, in fact, one of the deepest snows that there is any record of since the advent of white men in this country. There was an assurance of a bountiful supply of water for the summer of 1890. The creeks would all be booming and if there were any considerable number of fish in Lake Tahoe, they would ascend the streams in great numbers to spawn.

John G. Woodbury was at this time directing operations for the commission. The writer, accompanied by E. W. Hunt and a crew of five or six men arrived at the lake the latter part of March, 1890. Immediately the work of constructing traps was begun and arrangements made to collect spawning fish near the mouths of the different streams. Traps were constructed in Ward Creek, Blanchard Creek and Taylor Creek, and on Incline Creek in Nevada under permit issued by the Nevada commissioners. Seining crews operated at the mouth of Taylor Creek and off the mouth of Blackwood Creek. The work continued until August 23 and during the entire time less than 600,000 eggs were taken.

Owing to some biological reason, the fish did not ascend the streams to spawn or come near the shores in 1890, but there was a considerable number in the lake. A few were taken by market fishermen from very deep water in the center of the lake known as the "Pot Hole." In 1891, efforts were again renewed in an attempt to take eggs on the lake with better success. The market fishermen made statements that the fish were exterminated and that they could not be restored by any means.

The commission concentrated its efforts at Taylor Creek and from that time on, 1890 to 1895, there was an increase in the number of eggs taken. The largest number taken during this period was 2,500,000 in 1895. In 1896, 3,803,000 eggs were collected at the mouth of Taylor Creek. The maximum yield, however, did not come until 1909 when 6,130,000 eggs were collected. These eggs were hatched in the Tallac Hatchery and in the Tahoe Hatchery. The resulting fry were distributed in tributary streams of the lake and fishing increased in proportion. In 1914, the run of fish was still good, 5,549,000 eggs being collected. About this time the advent of the automobile brought thousands to the lake. They camped along the lake and streams. They caught the small fish before they descended to the lake.

As an illustration of how the artificial propagation and planting of fry maintained the run of fish in Lake Tahoe Basin, there were some 250,000 to 500,000 fry deposited in Taylor Creek each season and from these plants enough adult fish reached the mouth of Taylor Creek

each year so that with but very little effort, from three to five millions of eggs were collected annually for a period of twenty years. However, when the water of Fallen Leaf Lake was held back by a dam constructed at its mouth, the Taylor Creek station yield fell off rapidly. The fish were no longer attracted to the mouth of Taylor Creek and were compelled to search for other spawning streams.

There were from 80 to 115 market fishermen operating on the lake. The resort keepers and others during this time were diverting the water for domestic purposes and for irrigation. It is true, the large number of fish taken from the lake and the destruction of spawning beds in the tributary streams have all had a tendency to reduce the number of fish. Nevertheless, the most malicious agency in later years was the fishing out of the tributary streams. All the small fish were thus removed before they had attained the proper growth.

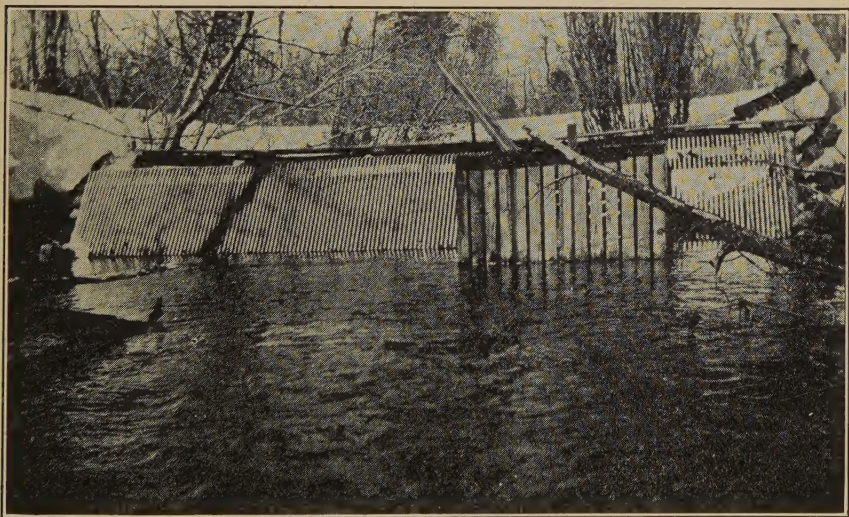


Fig. 59. Taylor Creek racks and traps for capturing spawn-bearing black-spotted trout. Taylor Creek, El Dorado County. Photograph by Joseph H. Sanders, April 1, 1922.

The native trout of Lake Tahoe do not feed near the surface during warm weather. They are not surface feeders at any time in fact. During the warm portion of the summer months, they descend to a considerable depth, following the plankton on which the minnows feed. This has been true of the lake ever since the fishermen began their operations. Only the old time fishermen who made a life study of the fish and on which they depended for a livelihood could find them during the warmer months of the year.

Since the nonsale of trout in California, the market fishermen have left these parts. Those who are engaged in fishing now are the tourists who do not take the time or have the patience to find the fish. There is, no doubt, a goodly number of fish in Lake Tahoe. Many fish could be caught if their feeding grounds during the summer months could be found by the average tourist. This fact is easily proven during the first few weeks of the open season when the water is still cold on the

surface and the creeks are running streams of icy water into the lake. Then fishing is very good for those who know how to fish. There never was any great fishing in the shallow waters on the west shore of the lake, particularly off Tahoe Bay and opposite Tallac where the water was shallow, but fish can be taken at Brockway, off Rubicon Point, Zephyr Point, Cave Rock and other places where the water is deep and where proper methods and tackle are used.

An effort to introduce surface feeding fish by the division has been made by planting steelhead and rainbow trout in Lake Tahoe. It is predicted that in a very few years, if this work can be increased to proper proportions fly fishing and sport fishing of every kind will be found on every part of the lake.

Resort keepers should bear in mind that every inch of water they take from the tributary streams for irrigation and domestic use is

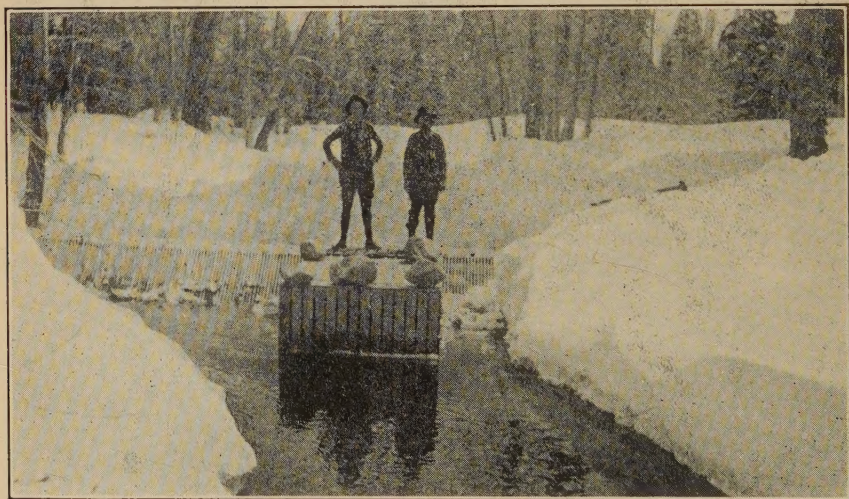


FIG. 60. Fish trap on Wood Creek, El Dorado County. Photograph by Joseph H. Sanders, May 1, 1922.

that much water less in which the fish can be raised. Several creeks have been diverted entirely for the beautifying of the grounds around the resorts. This may be very attractive to the resorts, but it is very hard on the fish. If the resort keepers desire to have fishing in Lake Tahoe, they must unite with the division in an effort to prevent all fishing in the streams tributary to the lake at all times of the year. Fishing must be confined to the main lake or the higher lakes above Lake Tahoe. The tributary streams must be left to flow undisturbed and the fry planted in them left unmolested.

During the spring of 1928 all the streams tributary to Lake Tahoe on the California side, on the recommendation of the division, were by an executive order of the Governor through the endorsement of the Director of the Department of Natural Resources, closed to fishing. This action will in a few years restore the fishing in Lake Tahoe, providing the closed area is respected.

In the opinion of the writer, when the young of the trout are held in the ponds, tanks or the hatching troughs, until they are five to eight inches in length, they become domesticated, fat, less active and lose their wild instincts. As a consequence, they fall an easier prey to the predatory fishes than when they are planted at a smaller size. The stomach contents of the large lake trout of Lake Tahoe and other places, on examination, will furnish all the evidence necessary to substantiate this contention.

Considerable comment has been going on among anglers and others regarding the predatory habits of the Mackinaw trout and condemning the division for introducing this species. The Mackinaw trout were introduced into Lake Tahoe at the request of the resort keepers and market fishermen and recommended by the United States Bureau of Fisheries. The state of Nevada introduced the first Mackinaw trout into Lake Tahoe about 1890 or 1891. The California Commission planted one lot of Mackinaw trout in 1895 with the consent and recommendation of the United States Bureau of Fisheries, who are still introducing these fishes in the larger lakes of the northwest according to their reports. Mackinaw trout are not any more predatory or cannibalistic than any other species of large trout. A careful analysis of the stomach contents of the silver trout of Lake Tahoe, the same size as the Mackinaw trout, will show they will devour as many of the minnows and trout from four to six inches in length as do the Mackinaw.

The number of Mackinaw trout in Lake Tahoe is not great enough to make any appreciable decrease in the other species. They are gradually increasing and may become plentiful in Lake Tahoe if the spawning area in the lake for this species is large enough to accommodate the spawners. Mackinaw trout do not enter the creeks to spawn, but deposit their eggs on reefs, in from four to eight feet of water. Here the wave action causes the moving of the water over the nests and this action of the water cleans and aerates the eggs just as running water does on a riffle in a stream. There are very few places in Lake Tahoe for the Mackinaw to spawn. In the opinion of the writer, the number will always be limited unless there are more spawning grounds in the lake than are at present known. The Mackinaw is a very fine food fish. It does not rise to a fly and therefore does not afford sport fishing, except for bait and spoon.

THE WHALES OF CALIFORNIA

By PAUL BONNOT.

Many people, even today, think of whales as being fish. In fact, there are numerous misapprehensions in regard to the cetaceans. Whales are mammals. In other words, their young are born alive and are fed on milk from mammary glands. The body temperature is approximately the same as any other warm-blooded animal. Because of the environment in which they live, the whales have a much modified body form. The fore legs have changed to flippers; the hind legs have, according to some authorities, gone to make up the caudal fin or flukes. The hair which once covered the body (the embryos of some

whales are still covered with hair at certain stages in their development) has disappeared and has been replaced by a covering of blubber, or spongy tissue, which lies between the epidermis and the body and is impregnated with oil. This blubber varies in thickness from an inch to ten or twelve inches, depending on the species, the size and the condition of the whale. The whale breathes with lungs, of course, like any other mammal. The spout, which the ancient observers considered a fountain of water, is nothing but the exhausted air being expelled from the hot, moist lungs into the colder atmosphere. The spouts of different whales are characteristic, some spouting in a straight, tall column, others having a low "bushy" spout, and the spout of the sperm whale is at an angle of forty-five degrees. Most of the larger whales when traveling will spout quite regularly. They will spout from three to eight or ten times and then run submerged for ten minutes or so, and repeat. The question of the ability of whales to remain submerged has never been satisfactorily settled. It has been claimed that the larger whales can remain below for an hour or more. The sperm whale descends to enormous depths to find the giant squid and cuttlefish on which it feeds. It is so constructed that it can withstand the tremendous pressure in the submarine valleys where its prey is found.



FIG. 61. Sperm whale (*Physeter macrocephalus*). (After Scammon, Marine Mamm. pl. XIV.)

In some popular science articles dealing with the little known animals, such as the whales and their possible ancestors, the extinct *Zeuglodonts*, the tendency is to produce animals of enormous size. The writers of these articles have apparently no conception of the physical difficulties which would embarrass an animal which outgrew its environment. No animal known to science has ever exceeded the size and bulk of the great blue whale (*Balaenoptera sibbaldii*) which is found in all the oceans of the world today. The blue whale grows to ninety or one hundred feet in length, with an approximate weight of one hundred tons. The only reason whales can attain such size is because of the supporting medium in which they live. At the other end of the size scale are the little dolphins, some of which are only three or four feet in length.

Whaling in California.

In 1787 four British whalers cruised for whales in the Pacific Ocean, presumably off the coast of South America. These were the first recorded whalers to enter the Pacific. Four years later, in 1791, seven American whalers rounded the Horn and worked along the coast of Chili. Six of these ships were from Nantucket and one was from New

Bedford. For many years thereafter the whalers gradually explored the Pacific. In 1838 the great Northwest Coast Grounds were discovered, and the whaling fleet working this area began to make its headquarters at San Francisco, in order to save the long and dangerous passage around the Horn. The oil was at first taken to the east coast by boat, but later the transcontinental railroad made it easy and convenient for the whaling fleet to use San Francisco as a base. Beyond furnishing ports of call for the whalers, California did not figure very much in the early whaling. In 1851 the first shore whaling station was established and shore whaling has continued spasmodically until the present day.

The old-time methods of whaling did not affect the California whales to any extent. The sperm and the bowhead were the chief species sought and they were found for the most part in the far north and on the other side of the Pacific. The most abundant whales on the California coast were the blue whales, the California gray whale, the finback and the humpback. These, for various reasons, were not molested by the old-time offshore whalers and the shore stations worked only a small, restricted area close to shore. The blue, California gray and finback whales are fast, hard-fighting animals, and generally destroyed more gear than they were worth, besides sometimes killing a few men. The California gray was taken in the lagoons of Lower California to some extent, and the shore stations also took those that were close to shore. The humpback was easily taken and was abundant, but the oil content was small and they were not considered a profitable acquisition. Until the latter part of the last century, the sperm and bowhead were fairly abundant and the whalers followed them, rather than the humpback.

As the more valuable whales were killed off and petroleum products took the place of whale oil, the old whaling methods became unprofitable and whaling was practically abandoned by the beginning of the present century. Tower, writing in 1907, in his "History of the American Whale Fishery," says: "Within the history of this country whaling has risen, passed its zenith and has now nearly sunk below the horizon of industrial importance."

For economic reasons, therefore, the whales had a short respite and were saved from extermination for a time. A short time before the European War, however, there was a revival of the industry. A young Norwegian named Svend Foynd invented an explosive harpoon which could be shot from a small cannon. This harpoon weighs about one hundred pounds, and in the head is a heavy charge of black powder which is exploded after it enters the whale's body. The gun from which this engine is thrown is a small brass cannon, mounted on the bow of a small steamer built especially for the work. The dead whales are towed to a nearby shore station or to a mother ship by the "killer."

In the old days, only the oil and bone were utilized and the carcass was cast adrift. Today, every scrap is used. Practically the whole body is steam cooked, to extract the oil, and the residue is made into meal which is used for poultry food and fertilizer. Even with improved methods, the profit is small and the large dividends declared in the last few years by the Norwegian companies working in the Pacific and

the Antarctic are only possible because of the large number of whales they are able to capture.

The whales which were considered too fast or too vicious to be taken in the days of the hand harpoon and whale boat are the species taken by the modern whale killer. Already the world population of whales is appreciably decreased, and it is only a question of a short time until whaling will be, very decidedly, a thing of the past. The

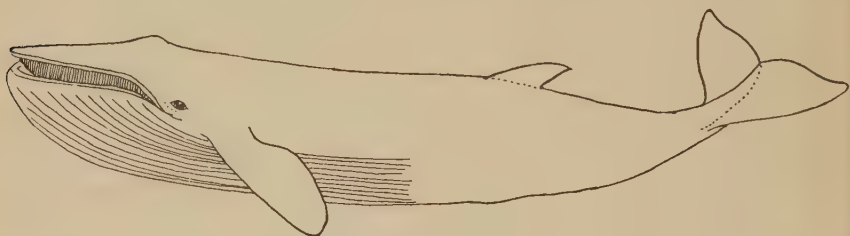


FIG. 62. The finback whale (*Balaenoptera velifera*). (After Scammon, Marine Mamm. pl. II.)

whalers' argument to the conservationist is that having become scarce enough to be commercially unprofitable, whaling will stop for lack of material, leaving the whales to "come back," which is true to a certain extent. Biologically, however, the thing has a different aspect. The whales breed slowly and such animals, after reaching a certain point, do not come back but disappear from the earth.

In dealing systematically with the whales found on the California coast, I have encountered the usual difficulty. Some of the species listed are based on descriptions and sketches, on single damaged skulls or a few bones, on minor color variations, trivial differences in external appearances and minor osteological irregularities, the result being that there are species which have no real existence at all and make trouble by cluttering the literature with a host of meaningless synonyms. Of the seventeen species considered by zoologists to be a part of the California fauna, I find that five may be synonyms of other species, and two have nothing to justify their existence except a written description and a few sketches. The remaining ten may be considered bona fide species. We place so much stress on the importance of taxonomy that we are content with our ability to manipulate Latin, forgetting the much more important things there are to be learned. We have allowed a convenient mechanical contrivance to become a dominating dogma.

CETACEA

Skull. Separation of the two parietals by the intervention of the supraoccipital, or their concealment by its overlapping. Overlapping of the muzzle generally by the premaxillae. Loose attachment between the various bones surrounding or connected with the organ of hearing. Absence or feeble development of the coronary process of the lower jaw.

Fore limb and girdle. Absence of the clavicle. Greater length of the radius and ulna than the humerus. Frequent presence of the typical number of bones in the wrist. Long and simple lungs. Unlobulated liver and complex stomach. Extraordinarily shortened but much convoluted brain.

"This combination of characters is found nowhere else among mammals, and indeed, the bulk of the peculiarities are confined to whales." Beddard, in his "Book of Whales," thus defines the order Cetacea.

Delphinidae.

The *delphinidae* or dolphins are whales of small or moderate size. They have numerous teeth in both jaws. Key to the *delphinidae* based on external characters.

Head with a beak which is usually distinctly marked off from the forehead by a constriction.

Dorsal fin absent—*Tursio*.

Dorsal fin present: falcate.

Beak distinct, short and rim-like—*Lagenorhynchus*.

Symphysis of mandible short:

Sides without longitudinal bands of color—*Tursiops*.

Sides with longitudinal bands of color—*Delphinus*.

Head without a beak, or with merely an obtuse ridge margining the upper jaw.

Crowns of teeth compressed; spade-shaped.

Dorsal fin present, triangular or slightly falcate—*Phocaena*.

Teeth conical, nearly or quite upright in the jaws.

Teeth in upper jaw deciduous; mandibular teeth few, confined to the regions of the symphysis—*Grampus*.

Teeth persistent in both jaws.

Pectoral fins very long and narrow; teeth confined to the anterior half of the rostrum—*Globicephalus*.

Pectoral fins broad, ovate; dorsal fin very high and prominent (especially in the male), size large—*Orca*.



FIG. 63. Bay or harbor porpoise (*Phocaena phocaena*). (After Elliott, from photo, U. S. F. C.)

Tursiops gillii (Cowfish).

Dall, Proc. Cal. Acad. Sci., V. 1873, p. 13.

Scammon, Marine Mamm., 1874, p. 288.

This species is based on a single mandible from Monterey, California, and a skull from Lower California, both collected by Captain Scammon.

"Of the external appearance of this dolphin we know little. Scammon, from two 'momentary observations,' describes it as 'black all

over, lightened a little below.' ” “His outline resembles that of a *Tursio* except that the dorsal fin is narrower than is common in that species.” True admits *T. gillii* as a species because of certain small marks on the skull.

Delphinus delphis (Common porpoise).

Linne, Syst. Nat., 10 ed., 1758, p. 77.

There are about two dozen synonyms of this species, most of them because of the different localities in which the animals were observed. The porpoise is an animal of cosmopolitan distribution. The species attains a length of seven feet six inches. The form is slender. The forehead slopes gradually. The dorsal fin is narrow. There are from forty-six to fifty teeth. The color is extremely variable.

This is the dolphin which is found abundantly in the literature of the ancient writers and historians. Their contemporary readers not being critical, through lack of knowledge, they mixed a charming variety of fact and fiction concerning this, to them, mysterious “fish.”

The dolphin enjoys playing about the bow of a swiftly moving vessel, running at the same speed, sometimes for hours, without apparent effort.

Lissodelphus borealis (Northern Right Whale Porpoise).

Tursio, Wagler, Nat. Syst. Amphib., 1830, p. 34.

Delphinapterus borealis, Peale, U. S. Explor. Exp. Mamm., Ornith., 1848, p. 35, pl. viii, fig. 2.

Leucorhamphus borealis, Dall, in Scammon, Marine Mamm., 1874, p. 296.

I can find no valid reason why this porpoise should not be a *Tursio*. The range is given as “the west coast from Bering Sea to Lower California.” The form which occurs in the southern hemisphere, *T. peronii*, differs from *borealis* in only a few minor color variations.

Lagenorhynchus obliquidens (Striped porpoise).

Gill, Proc. Acad. Sci., Phil., 1865, p. 177.

There are several synonyms to this species, which seems a valid one. This animal is about seven feet in length. It is greenish black above, with lateral broad longitudinal stripes of white, gray and dull black; ventral surface white. There are thirty-one teeth.

This is a north Pacific species. Scammon has considerable to say regarding it. “They are seen in numbers varying from a dozen to many hundreds, tumbling over the surface of the sea or making arching leaps, plunging again on the same curve or darting high and falling diagonally sidewise upon the water with a spiteful splash, accompanied by a report which may be heard to some distance.” He also speaks of their gorging themselves with fish, thus earning the name of “sea pig” imposed on them by the whalers.

Phocaena phocaena (Bay or Harbor Porpoise).

Delphinus phocaena, Linne, Syst. Nat., 10 ed., 1758, p. 77.

Phocaena communis, Lesson, Man. de Mamm., 1827, p. 413.

The bay porpoise reaches a length of five or six feet. It is dark colored above and whitish below. It is gregarious and numbers of them

often ascend large rivers for some distance. When spouting these little whales roll smoothly, showing only a very small portion of the body. The spout is very rapid, generally only a single "Phist!"

The bay porpoise was much esteemed as a delicacy in Europe at one time and, being considered a fish, was eaten on fast days.



FIG. 64. The grampus (*Grampus griseus*). (After Elliott, from cast 12839, U. S. Nat. Mus.)

Grampus griseus (Common Grampus).

Grampus, Gray, Spic. Zool., 1828, p. 2, Zool. Erbus and Terror, 1846, p. 30.

Delphinus griseus, Culvier, Ann. Mus., XIX, 1812, p. 14, pl. 1, fig. 1.

The grampus has no teeth in the upper jaw and but three to seven on each side of the mandible near the symphysis. It grows to a length of fifteen or twenty feet. The sides are slate colored, with irregular white markings. The grampus is a rare whale and, although of cosmopolitan distribution, is seldom seen.

Globicephalus scammoni (Scammon's Blackfish).

Cope, Proc. Acad. Nat. Sci., Phil., 1869, p. 22.

This species is based on one skull collected by Captain Scammon and from descriptions and drawings by him.



FIG. 65. The blackfish (*Globicephala melaena*). (From Trans. Zool. Soc., London, vol. 8, pl. 30.)

"The Blackfish was once abundant on the coast of Lower California. It grows to a length of fifteen feet. It is entirely black. There are eight teeth. They go in schools of from ten to one hundred, * * *. The food is squid. The oil content is small and dark in color."

Orca gladiator (Killer Whale).

Orca, Gray, Zool. Erbus and Terror, 1846, p. 33; 1866, p. 278.

Orca gladiator, Lacepede, Hist. Nat. des Cet., Paris, 1804, p. 302.

Orca ater, Gray, Sup. Cat. of seals and whales in the British Museum, 1871, p. 92.



FIG. 66. The killer whale (*Orca gladiator*). (After Scammon, Marine Mamm.)

Orca rectipenna, Cope, Proc. Phil. Acad., 1869, p. 25.

O. ater, Gray, and *O. rectipenna*, Cope, are based on figures and descriptions by Captain Scammon. They are supposed to be north Pacific species. They may be simply individual variations of the killer.

The killer is a predacious whale, fast, powerful and savage. It attacks and kills the much larger baleen whales easily. It kills and eats the largest sea lion bulls, and, apparently, the only animals in the sea which do not fear it are the sperm whales and the full grown walrus bulls.

The killers grow to be twenty-five or thirty feet in length. The coloring varies but is usually some pattern of black and white. They have ten to thirteen strongly recurved teeth and a large, pointed dorsal fin.

Dr. Eschricht, in a paper read before the Royal Danish Society of Sciences May 9, 1862, describes an *Orca* (*Delphinus orca*) which came ashore dead in Jutland. This specimen was carefully dissected by Dr. Eschricht, who states that the stomach contained thirteen common porpoises and thirteen seals. He says that the seals were all flayed and the hides missing, from which he draws the conclusion that the skin, being first affected by the powerful digestive fluids, is removed by the muscular action of the stomach and regurgitated.

Physeteridae.

The *Physeteridae* or sperm whales may be defined as follows: All or most of the cervical vertebrae fused. Costal cartilages not ossified. Pterygoids thick and meeting in the middle line; symphysis of mandible long. Teeth found in both jaws, but those in the lower jaw alone functional, often very reduced in number. Pectoral fins small. Two or more throat grooves.

Physeter macrocephalus (Sperm Whale).

Linne, Sys. Nat., 12 ed., i, p. 107.

There are seven or eight synonyms for this species, based on observations of sealmen and in several cases on a few bones.

The sperm whale can be recognized at once. It has an enormous head, quite one-third of the body. The head does not taper as do the heads of all the other whales, but ends abruptly. The mandible is long and thin and studded with conical teeth. The blow hole is single and on the left side, at the end of the snout. The sperm whale grows to a length of eighty or eighty-five feet. It lives on cuttlefish and giant squid.

The sperm whale was first described by Clusius in 1605. It has a worldwide distribution. From about 1800 to the beginning of the present century, it was the basis of one of the principal industries of New England.

Primarily a whale of the open ocean, the sperm was rarely taken by the shore whaling stations but was the chief support of the offshore whaling fleets. Several sperms have been landed at shore stations in recent years by the steam killers. The sperm is a vanishing species; it is already extinct commercially.

Ziphiidae.

The *Ziphiidae* or beaked whales may be characterized as follows: Functional teeth limited to one or two pairs in the mandible only. The vertebrae not more than fifty in number. Ribs not more than ten pairs, sternal ribs permanently cartilaginous. The blowhole is crescentic with the concavity forward. The pectoral fin is rounded and not large. The dorsal fin present and falcate in form. At least one pair of folds on the throat.

Berardius bairdi (Baird's Beaked Whale).

Stejneger, Proc. U. S. Nat. Mus., vol. 6, p. 75, June 22, 1883.

This species is based on a skull from Bering Island. In October, 1904, a single male of this species came ashore dead at Ferndale, Cali-



FIG. 67. The right whale (*Balaena sieboldi*). (After Scammon, Marine Mamm. pl. XII.)

fornia. This animal was forty-one feet in length. The skeleton and several photographs of it are in the National Museum. This is the only record of the species in California, as far as I know.

Balaenidae.

The *Balaenidae* are large whales which differ from the other families of whales in lacking teeth. The teeth are replaced by whalebone or

baleen; thin plates which hang from the roof of the mouth. The inner edge of the baleen is frayed out into coarse threads which strain out minute organisms from the sea water.

Balaena sieboldi (Pacific Right Whale).

Balaena mysticetus, Linn., Syst. Nat., i, p. 105.

Balaena, Gray, Cat. Br. Mus., 1866, p. 78.

Eubulaena sieboldi, Gray, Cat. Br. Mus., 1866, p. 97; 1871, p. 43.

There seems to be considerable doubt in regard to this whale. *Eubulaena sieboldi* is based on a drawing of a Japanese clay model.



FIG. 68. The California gray whale (*Rhachianectes glaucus*). (After Scammon, Marine Mamm., pl. II.)

Scammon was the first to mention any difference in the Right whales of the North Pacific and considers this species distinct. There are no records of *B. sieboldi* since Scammon's time. By some it is considered a synonym of *B. australis*.

Rhachianectes glaucus (California Gray Whale).

Agaphelus glaucus, Cope, Proc. Acad. Nat. Sci., Phil., 1868, No. 3, June-Aug., p. 159.

Rhachianectes glaucus, Cope, Proc. Acad. Nat. Sci., Phil., 1869.

The California gray whale grows to be forty or forty-four feet in length. In color it varies from mottled gray to black. The baleen is fourteen to sixteen inches long, and light in color. As far as is known, the gray whale is limited in range to the Pacific Ocean. There is no dorsal fin, and the throat grooves are reduced to two.

This whale was the main support of the old shore whaling stations. It is a shallow water species and migrates regularly up and down the coast, to Bering Sea in the summer and to the warm lagoons in Lower California and Mexico in the winter. When the sperm fishery began to decline, a number of whalers fished the gray whale in the southern lagoons. This was an enterprise calling for considerable fortitude, as the gray is not timid and inoffensive as are most of its family. The grays will take the offensive when molested, and have earned for themselves the name of "Devil Fish." With the usual lack of foresight displayed by man in exploiting a natural resource, the gray whales were hunted until they were considered extinct. It is a rare sight to see one today on the Pacific coast. A few years ago Dr. Roy Chapman Andrews discovered a regular fishery for the gray whale in Japan. The Norwegians have taught the Japanese modern methods of whaling and they are now putting a last touch to the exterminating of this whale. There are a great many gray whales on the western side of the Pacific

and there is some speculation as to whether some of these are not California whales which have taken to the other side of the Pacific as a means of avoiding the continual persecution they received on our coast.

Megaptera versabilis (Pacific Humpback).

Cope, Proc. Acad. Nat. Sci., Phil., July, 1869, p. 17.

M. longimana, Rudolphi, Abh. Ak. Berlin, 1829, p. 133.

This species was named from descriptions and sketches by Scammon. There is no type specimen or any material. It is considered by some a synonym of *M. longimana*, the humpback of world-wide distribution.

The humpback is rather ungainly in appearance as compared with the more slender species. It is short and thick, with disproportionately large pectoral fins and flukes. The dorsal fin is represented by a low hump. There are a number of rounded "bumps" about the snout which generally support barnacles. The food consists of crustacea and small fish.

Until just recently the humpback was not molested to any extent by the whalers. The supply of oil obtainable from them is comparatively small and the baleen is short. As the more profitable species have decreased before the harpoon gun, the humpback is now taken. Although still fairly abundant they are rapidly decreasing before the onslaught of the steam whaler.

Balaenoptera velifera (Pacific Finback).

Cope, Proc. Acad. Nat. Sci., Phil., July, 1869, p. 16.

This species was named from some samples of baleen and from sketches and descriptions by Captain Scammon from a single whale. By some it is considered a synonym of *B. physalus* of Linneas.

The finbacks have always been known to the whalers as animals to be avoided. Though not pugnacious, these whales have speed and stamina,



FIG. 69. The humpback (*Megaptera versabilis*). (After Scammon, Marine Mamm. pl. VII.)

as many lost whale lines and smashed boats entered in the logs of the old whalers will bear witness. Many a young, inexperienced harpooner in the old days learned by bitter experience that the finback was not to be trifled with.

Balaenoptera borealis (Sardine or Sei Whale).

Lesson, Hist. Nat. Cetac., 1828, p. 342.

The sei whale has been the basis of an extensive fishery in the North Atlantic for many years. It was not known to inhabit the Pacific until, in 1912, Dr. Andrews found it common about Japan. It may be a rare visitor to California waters. It grows to be forty or fifty

feet in length. It is black above and white below. The dorsal fin is high and the vent is exactly below the hinder edge of the dorsal. There are thirty-eight to fifty-eight throat grooves.

Balaenoptera davidsoni (Sharpheaded Finner).

Scammon, Proc. Cal. Acad. Sci. 4, No. 20, Jan., 1873, pp. 269-270.

This species is based on a single specimen. This was a female whale twenty-seven feet in length containing a faetus of five feet six inches. The pectoral fins are pointed. The baleen is pure white. There is no other record that I know of.

Balaenoptera sulfureus (Pacific Sulphurbottom Whale).

B. (Sibbaldius) sulphureus, Cope, Proc. Acad. Nat. Sci., Phil., July, 1869.

This species is based on some baleen and descriptions by Captain Scammon. It varies from *B. sibbaldii* only in a few color variations.

The sulphurbottom or blue whale is the greatest of all whales and, as far as we know, the largest animal which has ever inhabited the earth. It has a world-wide distribution. It is occasionally taken by the steam whalers in California waters. It grows to a length of ninety-



FIG. 70. The sulphur bottom of the Pacific (*Balaenoptera sulfureus*).
(After Scammon, Marine Mamm. pl. VIII.)

five to one hundred feet. The predominating color is a dark bluish slate above and white and yellowish below.

As the old time whalers regarded these whales as in the same fighting class as the finbacks, they were comparatively plentiful when the modern steam whalers began to work. A great number of them have been taken by the Norwegian companies in the last few years in the Pacific and Antarctic oceans.

Summary.

From a perusal of the literature and from personal field observations made at various times, it seems to me that the Ceteceans which can be included in the California fauna are as follows:

Balaena australis (*B. sieboldi*), a casual visitor.

Rhachianectes glaucus, a resident and migrant up and down the Pacific coast from Lower California to Alaska.

Megaptera longimana (*M. versabilis*), the most common whale today.

Balaenoptera physalus (*B. velifera*), a casual visitor.

Balaenoptera borealis, rare.

Balaenoptera sibbaldii (*B. sulfureus*), a casual visitor.

Physeter macrocephalus, a casual visitor.

Berardius bairdii, very rare, only one record in California.

Delphinus delphis, a common species offshore.

Tursio peronii (*Lissodelphus borealis*), doubtful even as a visitor.

Lagenorhynchus obliquidens, may be a visitor from the north.

Phocaena phocaena, a common species inshore and in the larger bays.

Grampus griseus, a rare resident.

Orca gladiator, fairly common.

The majority of the larger whales have a cosmopolitan distribution. The only exception to this that I know of is the California Gray, which is confined to the Pacific. As whales move about the oceans freely, there does not seem to be any necessity to divide them into different species merely on the strength of the geographical position in which they were observed, even in conjunction with color variations which might be individual peculiarities.

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WILD GOOSE SHOOTING IN CALIFORNIA TWENTY-FIVE YEARS AGO

By M. HALL MCALLISTER.

Twenty-five years and more ago a visit to the plains of the Sacramento or San Joaquin valleys during the fall and winter months afforded a great sight to the sportsman and it was my pleasure for a number of years to make annual trips to these attractive grounds.

One of the best outfits to go with was that of Doc. Stuart who had with him Abe Krump and Claude Kagee. They made the best bunch of "goose callers" imaginable and would pull a bunch of "Mexicans" or "Cacklers" out of the sky for miles around.



For Real, Live Sport **Wild . Goose . Shooting**

In Glenn County, Near
WILLOWS, CAL.

Cannot be Excelled Anywhere in
California, or on Earth

I GIVE sportsmen a guaranteed wild goose shoot over wild live decoys.

HAVING resided in this section all my life, I know all the favorite haunts and feeding grounds of the birds.

I AM the only expert goose caller in California who has a complete outfit for this, the greatest of all wild fowl shooting; who is able to bring the game to you, and who has the enviable reputation of having the best sportsmen return season after season.

I POSITIVELY bring birds within easy shooting range by means of expert goose calling.

I HAVE every facility tending to make your time count to the very best advantage. I know the business from A to Z.

THE most prominent sportsmen in the West have enthusiastically enjoyed this sport with me. Ask some of them.

I GUARANTEE that wild goose shooting will open your eyes. If you have never tried a shoot with me — come along.

I HAVE an automobile at your service to convey shooters to and from the grounds.

RATES—\$10 per day per man for shoot. Write, 'phone or telegraph.

FRANK N. BURGI, Willows, California.

"The Doc. Stuart outfit" was first located at Maine Prairie about ten miles east of Elmira, Solano County and then they moved to near Norman, about twenty miles south of Willows, Glenn County.

In these years the duck season opened September 15. There was no law on geese and they were considered as vermin by the early day farmers. By the middle of December the best duck shooting was over on the Suisun marsh at the Cordelia and Ibis gun clubs and the goose shooting then started and continued through December, January, February and March.

The ground where the shoot was to take place was selected and the holes dug and arranged some days ahead. The operators then "rested" for a few days, so the geese would see no one around.

Going out just about daylight on a beautiful, clear morning with the winter cold stinging your face and making you shiver, one soon forgot the beauties of nature or the discomforts caused by the cold by the wonderful sight; as far as one could see were great clouds of geese leading in all directions.

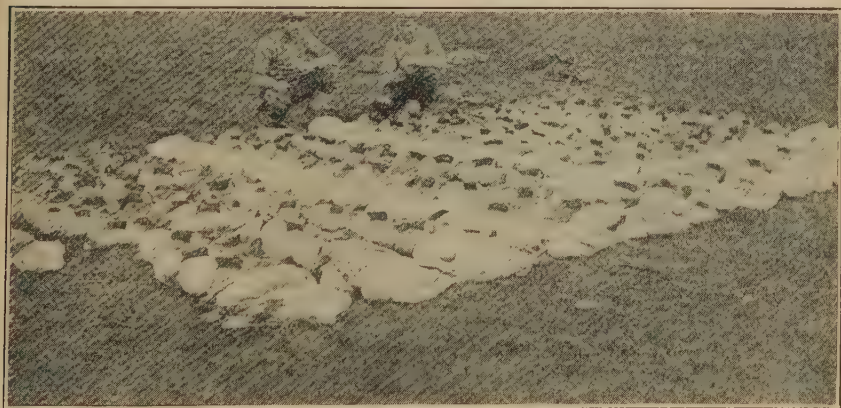


FIG. 72. A bag of about 150 geese during a morning shoot in Glenn County, December, 1904.

The shooting was before the days of live decoys. A few stuffed birds were staked on wires and as fast as the birds were bagged they were also "wired." Soon one had a fine showing.

It was all pit shooting; the holes in the ground being in a triangle and depending on the wind; the two front holes held the shooters and the rear hole, the callers. The birds were in such thousands that farmers were most glad to welcome shooters to drive the geese from their fields. As a consequence, bags were the desideratum tried for on all occasions.

The grand total for two morning shoots was 111 geese. These birds were all shipped to San Francisco and given away so that our friends had goose stew for a week. If there was a strong wind, as was generally the case, it was not easy shooting. The birds were remarkably active and keen and sometimes a bird killed clean in the air would be carried 100 yards by the gale and head shot birds frequently planed a quarter of a mile before falling with a thump. The geese, however, had little

chance as these blinds, if well made, were absolutely invisible 100 yards away.

The largest bags that I have reliable record of, but in which I did not personally participate, were made near Willows, Glenn County, in March, 1902. Four guns in two days shooting bagged 783 geese by actual count—an average of nearly 100 birds per gun per day.

The photograph herewith was taken in December, 1904, near Willows, shows 150 geese in one shoot by three guns; about 50 birds for each man.

My old record book, of my individual hunting trips, shows many shoots of several dozen geese. The largest shows 111 geese in two days for two guns. The friend with me on this shoot was Senor Carlos Herrera, who afterward became President of Guatemala, Central America.

The shoot was near Norman, Glenn County, the data being as follows:

December 4, 1905:

- 9 White geese, (*Chen hyperboreus*).
- 14 Grey geese (*Anser albafrons*).
- 20 "Mexicans" large brant (*Branta canadensis hutchinsii*).
- 28 "Cacklers" small brant (*Branta canadensis minima*).

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December 5, 1905:

- 4 White geese (*Chen hyperboreus*).
- 8 Grey geese (*Anser albafrons*).
- 22 "Mexicans" (*Branta canadensis hutchinsii*).
- 6 "Cacklers" (*Branta canadensis minima*).

40

Total, 111 geese.

A BIOLOGICAL SURVEY OF SALTON SEA

By GEORGE A. COLEMAN.

HISTORY

According to the geological records written in the rocks of the San Jacinto Mountains, bordering the present sea on the south, there has been at sometime a vast inland sea, extending from the Lower California coast to a considerable distance beyond the west end of the present sea.

"Tertiary deposits in these mountains contain great beds of fossil sharks teeth and univalves (oyster shells one foot in length), at 1000 feet above the present sea level."¹ Showing that there was a marine population equivalent to any great area of the Pacific Ocean at that time. The hydrogeological record as evidenced by the waterline marks still visible on the walls of the cliffs of these same mountains show a very changeful history.

The more recent written history, since the discovery of the sea by Captain Blake in 1853-54² shows that it has varied in extent from a body of water thirty-five miles wide, one hundred miles long and eighty-five feet in depth as reported by him to a dry salt bed which was

¹ McDougall, D. T. 1914. The Salton Sea. Carnegie Institution Publ. No. 193, p. 182.

² Blake, Wm. P. 1853. Lake Coahuilla. San Francisco *Commercial Advertiser*.

worked for many years for the salt it contained by the salt works at Salton. In the year 1907, this dry salt bed was again filled by the uncontrolled waters of the Colorado River making the present sea which is about seventeen miles in width at the widest point by forty-seven miles in length at the extreme ends. The depth has varied with the amount of rainfall, but has averaged probably forty-five feet at the deepest point near the geographical center.

Present Conditions—At various times during the years 1927 '28 and '29, the author has spent considerable time at the sea in a study of the water, plankton of the open sea, algae of the shoreline and water insects found therein including a collection of the fish at present living in the sea and tide pools in order to bring our knowledge of these conditions up to date and form a scientific basis for the introduction of the proper species of fish into the sea.

Sea Level—The existence and maintenance of an adequate supply of plankton, crustacean and insect life, especially in the shallow waters of the east end of the sea and the entire shoreline depends to a large extent upon the level maintained by the surface of the sea. Any material change in this level would greatly alter the character and quantity of this life, especially along the shoreline, upon which the species of minnows now living and breeding in the sea depend for food. Since any of the larger species of fish which we may introduce into the sea will necessarily depend largely upon the supply of minnows for their food, it is as well for us to know as far as possible what to expect regarding the sea level in the future.

With this idea in view, the author obtained from M. J. Dowd, chief engineer and general superintendent of the Imperial Irrigation District the records of the elevations taken since 1921.³

It is evident from these records that the level of the sea has raised almost three feet from 1921 to 1929. Since a variation of three feet would make but little difference in the character of the plankton and insect life, the author believes the division is perfectly safe in making a study of the present conditions—the basis for its fish introduction plans.

It is also shown that since the sea level has been under the control of the irrigation district it has been possible to keep it under control and to maintain an almost constant level. The variation of three feet being caused largely by an extremely heavy rainfall. Mr. Dowd assured me that it is their intention to maintain this level in the future.

³ Salton Sea Elevations. July, 1921, to January, 1929.

July 1, 1921—249.1 feet.
 January 1, 1922—249.2 feet.
 July 1, 1922—249.2 feet.
 January 1, 1923—249.9 feet.
 July 1, 1923—250.2 feet.
 January 1, 1924—249.1 feet.
 July 1, 1924—249.0 feet.
 January 1, 1925—250.2 feet.
 July 1, 1925—249.9 feet.
 January 1, 1926—249.2 feet.
 July 1, 1926—248.8 feet.
 January 1, 1927—247.8 feet.
 July 1, 1927—247.0 feet.
 January 1, 1928—246.4 feet.
 July 1, 1928—246.0 feet.
 January 1, 1929—246.5 feet.

CHEMICAL CONTENT OF THE WATER

Any study of the living organisms of the sea would be incomplete if it did not also include the chemical analysis of the water.

From 1907 to 1913, the United States Geological Survey made several



FIG. 73. Seining for minnows during biological survey of Salton Sea. Photograph by George A. Coleman, March 21, 1929.

analyses of the water. The Carnegie Report No. 193 for June 13, 1913, is most complete and is as follows:

Total solids	1,002.56
Water of occ. and hyd.	32.6
Sodium (Na)	323.08
Pot. (K)	3.45
Calc. (Na)	19.75
Magnesium (Mg)	16.22
Aluminum (Al)	.125
Iron (Fe)	.038
Manganese (Mn)	None
Zinc (Zn.)	None
Lead (Pb)	None
Copper (Cu)	None
Lithium (Li)	None
Chlorine (Cl)	473.89
Sulphuric (SO ₄)	124.65
Bicarbonate (HCO ₃) (vol)	15.74
Carbonic (CO ₂) Total (grms)	11.28
Silicic (SiO ₄)	2.18
Phosphoric (Po ₄)	Trace
Nitric (No ₃)	None
Nitrous	None
Oxygen consumed	.110
Boric acid	None

In conversation with Captain Charles Davis at his Mullet Island residence on May 21, 1929, I learned that he assisted in taking the above sample for analysis and that they were all taken just off shore in the sea opposite Mullet Island, the shoreline at that time covering this island.

MUD POTS

Situated about one-quarter of a mile inland and an equal distance from Mullet Island, these so-called "mud pots" which form quite a series of boiling mud springs, furnish a never failing source of supply of various minerals which find their way into the sea and are no doubt the main source of the minerals found in the sea water.

MINERAL WELLS ON MULLET ISLAND

During 1927, 1928, and 1929, two wells were bored to a depth of 900 and 1400 feet respectively through the solid rock formation of Mullet Island, at which depths a continuous flow of boiling mineral water was obtained. On May 21, 1929, the author accompanied by Paul A. Shaw, toxicologist at the Hooper Foundation for Medical Research, San Francisco, visited these wells, saw them in action and with the kind assistance of Captain Charles Davis secured samples of the flowing water for analysis. Mr. Shaw's analysis is as follows:

<i>Ion</i>	<i>Grams per 100cc</i>	<i>pH=6.5</i>
Carbonate -----		
Bicarbonate -----	0.03	
Ferrous Iron -----	0.005	
Chlorides -----	6.80	
Sulphates -----	0.02	
Calcium -----	1.60	
Magnesium -----	0.40	
Sodium and Potassium -----	2.04	
Nitrates -----	0.105	
Total solids -----	11.000	

The water flowing from these wells is allowed to run into a series of settling ponds where the minerals crystallize out and form a series of incrustations varying from white to yellow, green and purple, according to the mineral crystallizing. Here one can see nature's laboratory at work on a tremendous scale. When perfected, this system of settling ponds, will no doubt secure the most of the minerals contained in the water in a solid form leaving only a few unimportant ones in solution to pass into the sea.

Analysis of water of the open sea: On March 21, 1929, the author secured a sample of water near the geographical center of the sea and also from tide pools near Fish Springs where there is abundant evidence that the top minnow (*Gambusia affinis*) breeds.

Analysis of water from the open sea by P. A. Shaw, as follows:

<i>Sampled March 21, 1929</i>	<i>Grams per 100cc</i>
Carbonate -----	0.002
Bicarbonate -----	0.024
Chloride -----	1.63
Sulphate -----	.35
Calcium -----	.05
Magnesium -----	.15

*Sampled March 21, 1929**Grams per 100cc*

Sodium and Potassium.....	1.00
Total as analyzed.....	3.206
Borate	Positive
Nitrate	Negative
Total evaporated solids..... (105°C) =	3.68
Total solids ignition at low red..... =	3.32
Specific gravity at 20 degrees as compared to water at 4 degrees.....	1.033
Hydrogen-Ion Conc.....	pH.= 8.5



FIG. 74. Magdalena grass, food of the famous Salton Sea mullet.
Photograph by Charles Davis.

Analysis of tide pool water, same date as above, by P. A. Shaw, as follows:

	<i>Grams per 100cc</i>
Carbonate	0.00
Bicarbonate	0.03
Chloride	1.83
Sulphate	0.37
Calcium	0.09
Magnesium	0.08
Sodium and Potassium.....	1.20
Total as analyzed.....	3.60
Borate	Positive
Nitrate	Negative
Total evaporated solids (105°C).....	4.08
Total solids, ignition low red.....	3.78
Spec. Grav. 20°-comp, to water at 4°.....	1.034
Hydrogen-Ion Conc.....	pH.= 7.3

To complete our knowledge of the chemical contents of the water running into the sea, the author secured from chief engineer Dowd, the analysis of the waters of both the New and Alamo rivers made at the laboratory of the irrigation district for a number of years past.

As these are too extensive to publish in full, only the latest of January, 1929, are given here, the balance being on file in our office for reference.

Analysis of water at New River, samples taken below Reeds Dam Irrigation District. Laboratory sample No. 4302 and No. 123:

Total solids-----	167 parts per 100,000
Loss on ignition-----	30 parts per 100,000
Sodium carbonate (Na_2CO_3)-----	---
Sodium chloride (NaCl)-----	95 parts per 100,000
Sodium sulphate (Na_2SO_4)-----	66 parts per 100,000
Silt -----	157 parts per 100,000
Taken January 11, 1929.	

Sample from the Alamo River at North End Dam. Laboratory No. 4302 and No. 124:

Total solids-----	129 parts per 100,000
Loss on ignition-----	33 parts per 100,000
Sodium carbonate-----	---
Sodium chloride-----	57 parts per 100,000
Silt -----	182 parts per 100,000

The chemicals coming in from these two rivers are confined to a small per cent of sodium chloride which does not have any harmful effect on the growing crops where it is used for irrigation. For our purposes, therefore, these two rivers may be considered as fresh water streams.

SALTON SEA A REAL SEA

The chemical analysis of the water of the sea itself shows these waters to be comparable to that of the open ocean. Of recent years, biologists



FIG. 75. Salton Sea fishing fleet now abandoned. Photograph by Charles Davis.

and biochemists have accumulated a large amount of experimental data upon the relation of the hydrogen-ion concentration of the water to the living organisms therein. So much real knowledge is now available on this subject that this reaction of the water (known for short as the pH value) may be taken at least at a predictive value upon which the biologist may prognosticate the forms of life which will flourish therein.

As shown by Shaw, the water of the open sea has a pH of 8.5 and the tide pools of 7.3. The author's own determinations at various times come very close to this, *viz*, open sea = pH 8 -8.5 tide pools pH 7-7.8. It varies considerably during the season according to the temperature. According to Harvey⁴ (pp. 72-73) "Sea water from the open ocean has a hydrogen-ion concentration of between 10⁻⁸ and 10^{-8.3} grams per liter, or pH 8.1-8.3." Hence the reaction of the waters of Salton Sea to plant and animal life could be expected to be very close to that of the open ocean.

However, owing to the small area of Salton Sea and its shallow depth, the winds which sweep it from end to end daily keeping the water in almost constant motion and circulation make it impossible for any extensive development of any pelagic plankton. We have, therefore, to depend upon the shallow water of the shoreline to produce the plankton, insect and crustacean life needed to support the fish life in the sea. Fortunately, this area is large in proportion to the area of open sea, especially at the east end where the Alamo and New rivers enter the sea.

SILTING UP OF THE SEA

According to estimates made by the United States Geological Survey of 1911-1913, the rate of silting up at that time would completely cover and eliminate the sea in eighteen years. To date only a very small area at the mouths of the New and Alamo rivers has been covered.

In order to protect the breeding ground of the forms furnishing food for young fish, the channels of these two rivers should be kept open directly into the sea, so that the silt coming down in the water does not spread out too soon and choke out the growth in the shallow water. At the author's recent visit this was not being done and consequently there was a great area in which the water was only a few inches deep and in which great numbers of pelicans and other fish-eating birds were feasting on the minnows and young fish coming down these rivers which would otherwise enter the sea and form food for larger and more desirable sport fish. Chief Engineer Dowd has assured me that these channels would be kept open in the future.

BENTHAL AREA

The area in which benthic organisms which include all forms that are attached to the shore and bottom, or to plants growing on the shore and bottom and a host of other forms, which, though free swimming are associated with the attached forms, covers the entire east end of the sea, especially at the mouths of the New and Alamo rivers. These areas may be roughly located by the growth of cattails and other coarse water plants. There are other limited areas at the mouths of small streams, springs which flow directly into the sea and small stream at the west end with artesian wells for their source. I would estimate that in all about one-eighth of the area of sea is so covered. We have, therefore, this area in which the food for support of the minnow population, upon which the larger sport fish must depend for food and for the support of such fish as may subsist directly on plankton, insects and

⁴Harvey, H. W., 1928. Biological chemistry and physics of sea water. (Macmillan Company, New York, Ed. of 1928), pp. 72-73..

crustaceans. Any fish which we may introduce will therefore concentrate in this area especially in the younger stages and should be protected by not allowing any fishing in this area at any time.

FISH BREEDING AREA

The area to be so reserved is easily marked by township lines, *viz*, beginning at the northwest corner of township 11 south, range 11 east, San Bernardino Meridian, thence following township line to northeast corner of same; thence north on township line of township 10 south, range 12 east, San Bernardino Meridian, to the northwest corner of same, thence east on north line of township 10 south, range 12 east, San Bernardino Meridian to northeast corner of same. All sport fishing will then be confined to the open sea outside of this line. The area inside of this line, to, and including, the mouths of the Alamo and the New rivers as far as the first dams thereon to be set aside as a fish nursery for the express purpose of maintaining a supply of fish for Salton Sea.

If this is done we will have a basis to work on which will give us a reasonable assurance of being able to maintain a sufficient supply of sport fish in the sea to meet any demands made upon it by real sportsmen.

Commercial fishing in the sea, being now at an end as far as any profit in it is concerned, should be prohibited entirely.

FISH OF SALTON SEA

The first published account of the fish of Salton Sea, as far as I am able to find, is that of Dr. B. W. Evermann, in the *Copeia*.⁵

Dr. Evermann lists six species of fish as occurring in the sea at that time:

Common carp (*Cyprinus carpio*). The most abundant species at that time.

Bony-tail (*Gila elegans*). Said to be not uncommon. (I saw no specimens.)

Humpback sucker (*Xaurophen sypho*). Rather common. (I saw several specimens. They all had a starved appearance.)

Colorado River trout (*Salmo pleuriticus*). Although the water of the Salton Sea is quite brackish, strongly alkaline and very warm, this trout seems to thrive in it amazingly well. It is said to be fairly common. (I saw one fine example about 16 inches long. It was in excellent condition, albeit somewhat bleached in color.)

Common mullet (*Mugil cephalus*).⁶ Next to the carp the most common species. Numerous examples were seen. It is said to reach a large size (as much as 6 pounds) and to be unusually fine as a food fish.

Desert cyprinodont (*Cyprinodon macularius*).⁷ This interesting little fish was found in Figtree John Spring in a small oasis near the north end of the lake and some 7 miles southwest of Mecca. This spring, or

⁵ Evermann, Barton Warren. 1916. Fishes of the Salton Sea. *Copeia*, No. 34. pp. 61-63, August 24, 1916.

⁶ Thompson, Will F and Bryant, Harold C. 1920. The mullet fisheries of Salton Sea. CALIFORNIA FISH AND GAME, Vol. 6, No. 2. pp. 60-63, 3 figs. April 19, 1920.

⁷ This cyprinodont appears to be found in many of the isolated springs and water holes in the deserts of southern California. Only this week (June 1) Samuel Hubbard of Oakland, brought me 14 fine specimens from Saratoga Springs, Death Valley, where Mr. Hubbard says they are very abundant.

waterhole, was grown up thickly with cattails (*Typha latifolia*) and the surface of the water was covered with a thick coating of algae of various species. The water was only a few inches deep and quite warm, perhaps as warm as 90 degrees to 100 degrees on hot days. The fish, however, were active and in good condition. I caught a number of them and succeeded in bringing two alive to San Francisco. One of them died a few days ago—the other is alive and doing well.



FIG. 76. Fishermen examining nets used in taking mullet in the Salton Sea.
Photograph by Charles Davis.

PRESENT STATUS OF FISH LIFE

In his several trips to the Salton Sea, the author has paid particular attention to checking up on the number of species of fish now found in the sea and their abundance.

The carp disappeared several years ago in what seemed to be an epidemic. Captain Charles Davis says they came up in shoals of dead fish on the shore at and near Mullet Island, the stench being almost unbearable for sometime. Most of these fish were carp, but there were other fish mixed with them.

The mullet have also almost disappeared. I interviewed the mullet fishermen while they were working this spring. They stated that they could find but one small school of large fish and they moved about all over the sea. They say what they do catch are all large fish and in the proportion of about one male to 100 females. They believe the mullet are not now breeding in the sea. In a trip of forty miles on the sea over their supposed haunts, I saw only one good sized mullet on March 21 of this year.

The Colorado River trout is occasionally seen near the east end of the sea.

The humpback sucker is reported as rather common.

The author, assisted by several deputies, during the trip in March, made quite an extended search for the desert cyprinodont and found it at nearly every point where we touched shore, from a spring about seven miles above the Hartley Salt Works on the north shore of the sea, around to Fish Springs and Figtree John Spring where Dr. Evermann

originally discovered it. We found it abundant in all these places, but especially so along the shore near the Hartley Salt Works. Here it thrives amazingly in the open sea water and Mr. Hartley states that it gets into their salt vats and will live in salt water up to 50 per cent saturation, at which point it begins to die. It evidently breeds in the tide pools and fresh water coming from these springs in among heavy growths of cattails.

While hunting for the cyprinodont at Fish Springs, the author discovered a small viviparous minnow breeding in the spring and also in tide pools of sea water along this shore. These were turned over to W. I. Follet, of Oakland, who has kindly identified them as *Gambusia affinis*, Baird and Girard. Since this time the author has found this minnow to be quite abundant at several points around the shore.

Mr. Follet also identified the cyprinodont collected as *Cyprinodon macularius*, Baird and Girard, or the same species listed by Dr. Evermann.

These two minnows are in sufficient abundance in the sea to form the food of a considerable population of sport fish since they are found all around the shoreline and seem to be able to maintain themselves against a horde of fish-eating birds of various species.

RECOMMENDATIONS FOR STOCKING

After a study of the present conditions and a fairly good knowledge of the habits of the striped bass, I believe if the young bass were introduced into the area designated as breeding grounds at the east end of



Fig. 77. Recession of the Salton Sea has left great shallow flats and made necessary this method of transporting fishing gear and catch. Photograph by Charles Davis.

the sea late in the season (October would be probably the best time) they would have a good chance to succeed. Since we have no precedent or example of introducing the striped bass into a landlocked sea, it will be in the nature of an experiment, but one which I believe to be well worth trying. Certainly no fish could be more desirable as a sport fish.

THE REPRODUCTION OF FISHES

By PAUL BONNOT.

From time to time inquiries are received by the Division of Fish and Game requesting information relative to the breeding habits of fishes. These inquirers range from students working on some problem of ichthyology to housewives who, on cleaning fish brought home by some angling member of the family, are surprised to find some of the body cavities filled with small replicas of the larger individual. The finding of such fish has led to the erroneous idea that some fishes swallow their young in time of danger, disgorging them when the danger has passed.

Among the cold-blooded vertebrates, there are three types of reproduction, which are termed oviparous, ovoviviparous and viviparous. There are fishes represented under each of these types. The eggs of an oviparous fish may be fertilized internally or they may be fertilized after they have been exuded into the water. The eggs of oviparous fishes contain a yolk, as a food supply for the young fish. The eggs "hatch" in the water. In the ovoviviparous type of reproduction, the eggs are fertilized inside the body of the female and are "hatched" there. The young fish are in some cases furnished with a yolk sac; in others they are attached to structures on the walls of the oviducts, analogous to the mammalian placenta. In either case, they are in a very undeveloped state when they emerge from the egg and must remain for a time in the ovary or oviducts, and are deposited in the water fully formed and able to provide for themselves. In the viviparous fishes, the eggs are fertilized internally—in some cases while still attached to the follicle. The eggs are not provided with a yolk. The necessary oxygen and nourishment are derived directly from the female, thus approaching the conditions found among the warm-blooded vertebrates.

The necessary contact between the eggs and spermatozoa is effected by various means. In most of the oviparous fishes the eggs are either set adrift in the water or attached to water plants and stones, or they are buried in sand, gravel or mud. The males exude the milt in the vicinity of such eggs and water currents bring about contact between the spermatozoa and eggs. In a few of the oviparous fishes the spermatozoa are introduced into the female by actual copulation and the eggs are fertilized previous to their exudation into the water. A few of the oviparous sharks and rays of this type enclose the eggs in a tough leathery shell, of a rectangular shape, with a long tenacle at each corner. In all the ovoviviparous and viviparous fishes the spermatozoa are introduced into the female and the eggs fertilized in the oviducts or ovary. The male intromittent organ is some modification of the ventral or anal fins. In the sharks and rays, there are claspers, a paired structure with corresponding grooves on their inner surfaces, which together form a closed tube for the transfer of the seminal fluid. In the top minnows and surf fishes, the modification generally takes the form of a tube between the elongated anterior rays of the anal fin.

In the ovoviviparous and viviparous fishes the fertilization of the eggs and the subsequent development of the embryos are very variable.

Eigenmann* found that in *Cymatogaster aggregatus*, one of the surf fishes, the following cycle occurs. Copulation takes place in June or July. The spermatozoa remain dormant in the ovary until December, when they become exceedingly active. The eggs mature and are fertilized between November 1st and February 1st, the eggs in larger fish being more numerous and maturing earlier than those in smaller fish. The young are liberated during May and June. The young fish are gravid in one year.

There are several different methods of providing the young fish with nourishment and oxygen during gestation. In some of the sharks, the embryos are attached to the walls of the oviducts by structures analogous to the mammalian placenta. In the surf fishes, the embryonic fish, as soon as the digestive tract is formed, consume the spermatozoa still remaining in the ovaries and are then nourished by material from the breaking down of the epithelia lining of oviducts and uterus. In most of the viviparous teleosts, or fishes having bony skeletons, the embryos obtain a certain amount of nourishment and oxygen through osmotic action between the surface of the small fish and the closely applied ovarian structures.

The following families of fishes are known to be either ovoviviparous or viviparous. All other fishes, as far as is known, are oviparous. There are species contained in some of the enumerated families which are oviparous. The rock fishes (*Scorpaenidae*) and surf fishes (*Embiotocidae*) are the only families in which there are no oviparous members.

Sharks and Rays—

- Carchariidae* (Blue Sharks)—Ovoviviparous.
- Sphyrinidae* (Hammerhead Sharks)—Ovoviviparous.
- Rhinidae* (Angel Fish)—Ovoviviparous.
- Galeidae* (Requiem Sharks)—Ovoviviparous.
- Spinacidae* (Spiny Dogfishes)—(some) Ovoviviparous.
- Trygonidae* (Sting Ray)—Ovoviviparous.
- Myliobatidae* (Eagle Ray)—Ovoviviparous.
- Mantidae* (Bat Fish)—Ovoviviparous.

Top Minnows—

- Poeciliidae*—(most) Ovoviviparous.

Rock Fishes—

- Scorpaenidae*—(all) Ovoviviparous.

Blennies—

- Blennidae*—(most) Ovoviviparous.

Eelpouts—

- Lycodidae*—(most) Viviparous.

Surf Fishes—

- Embiotocidae*—(all) Viviparous.

The number of progeny produced under the different types of reproduction varies according to the degree of protection afforded the eggs and young fish. The oviparous fishes which deposit their eggs unfertilized in the water, produce comparatively large numbers of eggs. Only a small percentage of the fish that these eggs represent reach maturity. When the eggs are fertilized before being exuded into the water, one

* Bull. U. S. B. F. 1892 (1894) V XII, pp. 401-478.

element of chance is removed and the number of eggs is accordingly reduced.

Among the ovoviviparous and viviparous fishes, the eggs and young are protected through the period of greatest danger. The available space for growth is limited and, therefore, the number produced is comparatively small. Most of the oviparous fishes seem to have definite spawning periods at regular intervals. Such fish as sardines, striped bass and carp spawn regularly once a year. On the other hand, salmon spawn but once during a lifetime, when they are from four to six years old. The ovoviviparous and viviparous fishes which produce their young in small numbers seem to have a more or less continuous period of reproduction. In the ovaries of such fishes will be found minute immature eggs in conjunction with ripe eggs ready for fertilization. The eggs mature in small numbers and, as soon as the young fish are liberated, another set of eggs is ripe and ready to produce another brood.

*Number of Young Observed in Different Species of Viviparous Fishes.**

Rock Cod—

Sebastomus—Many thousands.

Rose Fish—

Sebastes marinus—1000.

Top Minnows—

Gambusia patruelis—20 to 25.

Anableps gronovii—

female, 7 inches—4 to 5.

female, 10 inches—18.

female, 10 inches—7.

Surf Fishes—

Hysteroecarpus traski—16.

Hyperprosopon argenteus—7 to 12

Hypsurus caryi—8.

Ditrema jacksoni—8 to 60.

Phanerodon cateralis—21 to 80.

Phanerodon furcatus—10 to 23.

Amphistichus argenteus—47 to 80.

ACETIC ACID AS A CONTROL AGENT FOR CYCLOCHAETE AND GYRODACTYLUS IN HATCHERY TROUT ¹

By H. VAN ROEKEL.

During May, 1929, a disease outbreak among steelhead trout (*Salmo irideus*) in a hatchery was called to the attention of this laboratory. Upon investigation the following information was obtained.

HISTORY

The hatchery is supplied with water taken from a near-by stream, which in turn, is supplied with water flowing from springs found along

* Eigenmann, C. H. Bull. U. S. B. F. 1892 (1894) V XII, p. 404.

¹ Contribution No. 4 from Fish and Game Laboratories at The George Williams Hooper Foundation for Medical Research, University of California, San Francisco.

its channel. The amount of water received from these sources, however, is very small. Approximately one-half mile above the water intake for the hatchery, the stream also receives water from an electric power plant. This water is not as pure as that from the springs because it travels through a six-mile flume and an open reservoir before it reaches the power plant. A marked difference is observed in the clearness of the stream water above and below the point where the water from the plant enters the stream. Fifteen days prior to the date when the disease was reported, the power plant commenced to shut down during the night and no water would flow into the stream during this time. While the water was shut off at the plant, there would be an insufficient amount flowing through the hatchery. At this time the water became noticeably contaminated with barnacles. This condition may have some relation to the parasitic outbreak in the fish.

CAUSE OF THE DISEASE

Microscopic examination revealed that the fish were infested with skin parasites, namely: cyclochaete and gyrodactylus. The former was found on all fish examined while the latter was observed on only a few.

COURSE OF THE DISEASE

The first sign of the disease, observed by the hatchery foreman, was a slight increase in mortality. The organisms, without doubt, had gained a firm foothold at this time. It is difficult to state when the fish first became infested. A rise of temperature (4 degrees Fahrenheit) occurred when the first mortality was observed. The May temperatures ran fairly constant, with a mean temperature never exceeding 59 degrees. A marked increase in mortality was observed four days after the first evidence of the disease. During a period of five days an approximate loss of 200,000 fish was experienced.

SYMPTOMS

In general, the fish appeared to be less active and greatly weakened. They inclined to rest near the surface of the water or lie on the floor of the trough. Due to weakness, the current of the water would hold them near the foot end of the trough. The outline of the fins appeared to be ragged which greatly interfered with the function of the fins, especially the tail fin. A short rapid side motion of the posterior third of the body was observed in fish with injured tail fins. The stronger fish would often attack the weaker ones which would result in a large number of bobtailed fish. Upon close examination with the naked eye, the parasites appeared as white pin-point specks on the fins. In heavily infested cases they were easily detected.

LESIONS

Microscopic examination revealed the parasites moving about on the fins and body proper. The organisms could be found on any part of the body, but in light infested cases they were generally confined to the fins. The structure of the fins was greatly injured. The rays appeared to be nude of skin and often broken at the border of the fin. This injury not only affected locomotion, but also resulted in a great loss of blood.

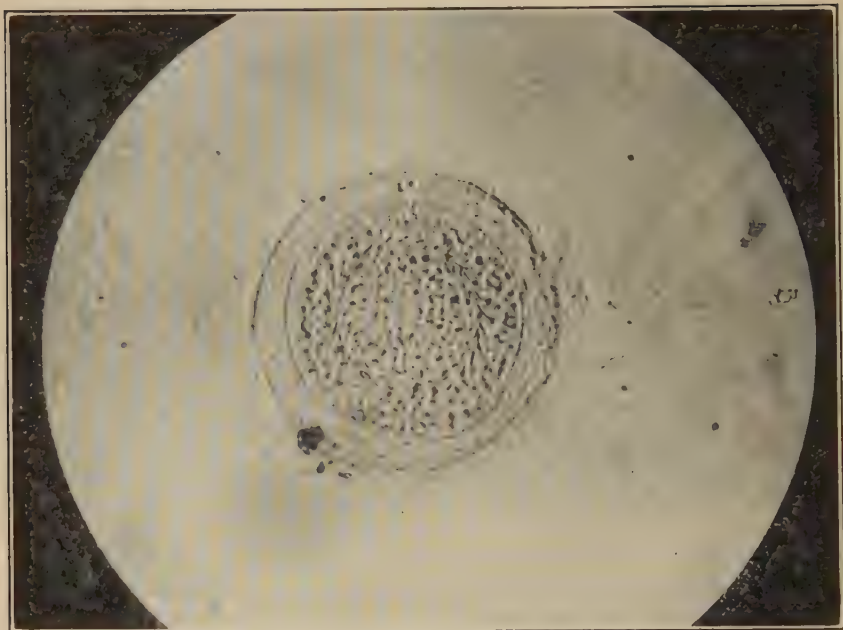


FIG. 78. Cyclochaetae. Skin and gill parasite isolated from two months' old steelhead trout. Enlarged 325 times.

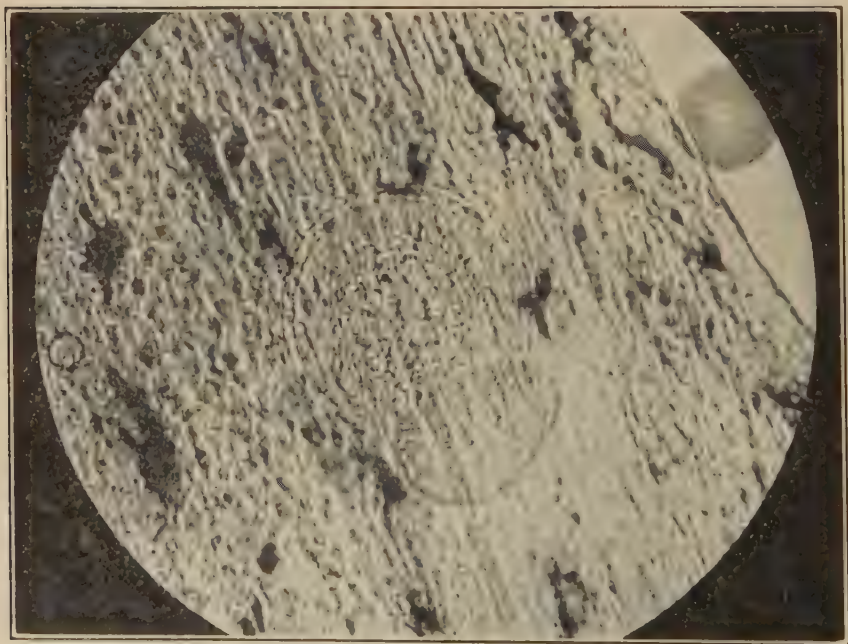


FIG. 79. Cyclochaetae attached to tail-fin of two months' old steelhead trout. Enlarged 325 times.

TREATMENT

In treating fish infested with parasites one must consider the type of organism to be eradicated, the efficacy of the agent on the parasite, duration and method of application, after effects on the fish and the cost of the agent. To obtain this information in an expedient manner, it is best to first treat a small number of fish. The strength of the agent and duration of the treatment are dependent upon the type of parasite and the size and condition of the fish. It is known that *gyrodactylus* can be eliminated with a weak solution of acetic acid. Since no specific treatment for *cyclochaete* was known, several agents were considered. Acetic acid solution was first employed. It was observed that *cyclochaete* can be eliminated from two months old trout if bathed in a .15 per cent solution of glacial acetic acid for one minute. This strength of the solution and duration of the treatment did not produce any serious after effects on the fish. With a net the fish were immersed into a tub containing the acetic acid solution. Approximately 4000 fish could be treated at one time. A deep net as used in hatchery practice for transferring fish was employed. Every precaution was taken to keep the fish in constant contact with the acid solution for the required time. The upper portion of the net was also disinfected by dipping it frequently into the solution. If care is exercised few fish escape from the net. At the end of 45 to 60 seconds some of the fish will commence to show signs of distress and turn over on their side. The duration of the treatment should not exceed one minute in the size treated as it would result in a heavy loss. The loss is dependent upon the condition of the diseased fish.

After the acetic acid bath the fish were placed in troughs which had been cleaned and disinfected with a $2\frac{1}{2}$ per cent solution of formalin. The fish should be placed in the trough near the water inflow where conditions are most suitable. A large number of fish will fall to the floor of the trough and appear as dead, but within 20 to 30 seconds all will have recovered and appear normal. A slight increase in mortality was observed for some hours after the treatment. The dead fish were the weaker infested ones which could not survive in spite of any treatment. The mortality dropped down to normal about forty-eight hours after the treatment. The general condition of the fish improved rapidly. Frequent microscopic examination of dead and live fish revealed no *cyclochaete*. The treatment did not eliminate the *gyrodactylus* completely, as this parasite was found on two different specimens of all the treated fish examined. Further treatment would be necessary to eliminate this organism completely.

Among other agents employed it was observed that a .25 per cent formalin solution would kill both *cyclochaete* and *gyrodactylus* within $1\frac{1}{2}$ minutes. The net treatment was employed as with the acetic acid. Formalin, however, appeared to be slightly more toxic to small fish.

Methylene blue² (1-1000 of a saturated solution) did not kill the organism at the end of one hour. Experiments with lower dilutions were not attempted because the agent would be more expensive for general treatment than acetic acid or formalin solutions. Fish remained alive for at least twenty-four hours in a 1-1000 methylene blue solution without being areated.

² Certified, Coleman & Bell, Northwood, Ohio.

Acriflavine was also used in a very dilute solution (1-750,000). This agent can not be recommended because it did not kill the organism and proved injurious to the fish. The organisms were alive after five minutes exposure to the solution.

The action of the acetic acid on the organism is not definitely known. Acetic acid belongs to the group of simple acids which act as an external irritant.

SUMMARY

The acetic acid solution was found to be effective in the control of cyclochaete and gyrodactylus and the least toxic to fish. Formalin, although slightly toxic, can also be recommended in the control of these parasites. Methylene blue and acriflavine can not be recommended because the cost of treatment would be far greater than that of acetic acid or formalin if stronger solutions were employed.

All instruments and troughs can be readily disinfected with 2½ per cent formalin solution which has proved to be effective.

The strength of the disinfecting agent depends upon the condition and size of the fish and the organism which is to be eradicated.

Other agents such as dilute sulphuric acid, chloride of lime and copper sulphate were not employed which also may prove to be of some merit in eradicating these parasites.

The disinfecting solutions can be prepared by the fish culturist with little difficulty. The acetic acid should be 99 per cent pure and formalin should contain 40 per cent formaldehyde. These agents can be obtained from any chemical company. The dilute solution (.15 per cent) may be prepared according to the following ratio:

One part of acetic acid (99 per cent) + 658 parts of water.

One ounce of acetic acid (99 per cent) + 5 gallons and 18 ounces of water.

76 cubic centimeters acetic acid (99 per cent) + 50 liters of water.

THE NORTHWARD OCCURRENCE OF SOUTHERN FORMS OF MARINE LIFE ALONG THE PACIFIC COAST IN 1926

By CARL L. HUBBS AND LEONARD P. SCHULTZ.

While engaged in collecting and studying the fishes of the northwest coast during the summer of 1926, we secured some information on the occurrence during that season of certain forms of fishes and marine invertebrates well north of their usual range. According to general testimony and indications, the summer of 1926 was notable for this tendency of marine forms to stray northward along the coast.

Our observations of course were duplicated by those of some other naturalists, among them J. T. Nichols, of the American Museum of Natural History. He writes as follows in "Natural History" (Vol. 26, No. 6, pp. 611-612):

"Various unrelated bits of data tend to show that the present season (1926) was one where warm water conditions extended unusually far to the north along the coast. It was also one of a heavy take of salmon at False Pass (entrance to Bering Sea) and in the Bristol Bay area of Alaska * * *. In July and August the writer found comparatively warm water conditions prevailing farther north than he had

anticipated. Coming in southeast, west of the Queen Charlotte Islands, when about the 52d parallel of latitude was reached, there was a band of water several miles wide, thickly strewn with *Velella*. The glistening sails of this little animal dotted the smooth blue surface of the sea as the falling petals of apple blossoms do the grass under apple trees. South of this line phosphorescent ctenophores flashed their sparks of blue light in the ship's wake at night. Again, farther southeast, a fragile pelagic stalked barnacle was numerous. Several of these barnacles float attached to a central globular mass seemingly of the same structure as that of their stalks. At about 50 degrees north, the steamer passed close to a sea sunfish three or four feet across, swimming in a vertical position, its upper fin projecting somewhat above the surface of the water."

We also found an ocean sunfish (*Mola mola*) north of its usual range, although not nearly so far north as Nichols' record. His fish



FIG. 80. Ocean sunfish caught far north of its usual range near Lapush, Washington, 1926.

was seen off the northern part of Vancouver Island, while ours (Fig. 80) was taken by a salmon troller near Destruction Island, off northern Washington. This odd fish created a considerable amount of interest when brought into the Indian village of Lapush, where we were staying at the time. Many of the fishermen as well as the Indians—a number of whom engaged in pelagic sealing—had never seen a sunfish in neighboring waters. It was obviously a stray from the southward. This specimen was caught on June 24. Later, during the first half of August, we found ocean sunfish common off Newport, Oregon, seemingly more abundant than usual. A halibut skipper, fishing off Yaquina Head, brought us in a fine example, of relatively small size.

This northward extension of the range of the ocean sunfish in 1926 appears to have been related to the unusual occurrence of the "Portuguese man-o'-war" (*Velella*) far to the north of its usual range. Nichols, in the paper quoted above, mentioned seeing large numbers

of these little purple creatures sailing along at the latitude of 52 degrees (north of Vancouver Island). They also occurred generally along the Washington and Oregon coast during the summer of 1926, and everywhere were regarded as unusual if not quite strange. Near Lapush, Washington, these animals were washed ashore in windrows, during the latter part of June. The sunfish caught near Lapush had eaten heavily on *Velella*, and on nothing else. It is probable that the sunfishes had followed the "Portuguese men o'-war" to the north.

Some other invertebrates were generally thought to be especially common northward in 1926. This was held to be true, for example, of a sea urchin (*Strongylocentrotus purpurascens*), especially at Cañon Beach, Oregon.

Anchovies (*Engraulis mordax*) occurred in most unusual abundance in the summer of 1926—so much so as to receive frequent newspaper notice—in the mouth of the Columbia River. They were here mistaken by the salmon fishermen for sardines.

A thresher shark¹ (*Alopias vulpes*) was caught late in the summer of 1926 in Coos Bay, Oregon. This is far north of the usual range of this species, and the local fishermen did not recognize it. Although we did not actually see this thresher shark, its identity was made certain by the examination of a sketch and measurements of the fish, sent us by Ben Smith, a very observant fisherman of North Bend.

Mackerel (*Pneumatophorus diego*) also appeared, though rather sparingly, in the channels of Coos Bay, Oregon, during the summer of 1926. They were regarded by fishermen as new to this bay. They have, however, been taken at times in Puget Sound.

Jack smelt (*Atherinopsis californiensis californiensis*) were likewise sporadically common in the channels of Coos Bay in the same summer. Ben Smith, who for some years has made a living fishing for bay smelt (*Atherinops affinis oregonia*) in Coos Bay, and who has taken a keen interest in his catch, insists that he never caught the jack smelt before 1926 and that he noticed on first taking them they were different from the ordinary bay fish. He certainly distinguished clearly between the two, both as to habits and appearance, in 1926. Jack smelt were also taken in Yaquina Bay, Oregon, in 1926, but the less observant fishermen there did not distinguish them from the bay species.

The one previous record of this species from north of California, is for British Columbia, and is a very doubtful one.

Hake (*Merluccius productus*) were at one of their occasional high points of abundance in and near Yaquina Bay, Oregon, in early August, 1926. At such times of abundance many hake are stranded on the sand beaches of the adjacent surf or on the sand flats of the bay.

Two other fishes found in great numbers near the mouth of Yaquina Bay in August, 1926, were the slender smelt, *Allosmerus attenuatus* and *Spirinchus starksi*, species which make up much of the "white-bait" of the San Francisco market. But most of these smelt were killed by the blasting in the harbor mouth, and might not otherwise

¹ During July and August, 1926, members of the staff of California State Fisheries Laboratory noted an unusual number of hammer-headed sharks, *Sphyrna zygaena*, in the San Pedro fish markets. This is a notable northward extension of the normal range of this species as these sharks, inhabiting warm seas, are delivered but rarely to the markets of the Los Angeles region. —F. N. Clark, California State Fisheries Laboratory, April, 1929.

have been seen in numbers. It can not be stated with any certainty that these species were actually in unusual abundance in 1926.

We took in Oregon and Washington a number of other California types of fishes—certain surf fishes, sculpins and rock cods—which have not been reported in the scientific literature as occurring in these states. But in these cases we obtained no indications that these species were not normal and permanent residents in these northern waters. The fact that they have not been recorded so far northward is merely an index of the very meager amount of attention which has been given to Oregon and Washington by the collectors and students of fishes.

Another southern fish, the striped bass² (*Roccus lineatus*) occurred in commercial abundance in Oregon, especially in and about Coos Bay, during the summer of 1926. This species, however, appeared here first, in sufficient quantities to attract attention, to the summer of 1925 (as already noted in this journal by Scofield and Bryant, Vol. 12, 1926, p. 57).

Crawford has reported in Copeia (No. 160, 1927, p. 183) the apparent straying of the Japanese *Decapterus* into Alaskan waters in 1924 and 1925. Whether this movement was unusual, we can not say. He also reports the occurrence of the pomfret (*Brama raii*) and the torpedo (*Tetronarce californica*) north of Cape Flattery in September and October of 1925.

Just before we left the Oregon coast, to be exact on August 24, 1926, albacore (*Germo alalunga*) were caught off that state for the first time, so far as we could learn. Two salmon trollers, fishing between Coos Bay and the mouth of the Suislaw, each landed one of these fishes, strange to them, and one of them saw a small school. The fish was equally unknown to the other fishermen and the fish dealers of Marshfield, but an examination of the large head of one and the fishermen's clear description of the rest of the body, and particularly of the plain color and great length of the pectoral fin, left no doubt in our minds as to the identity of the fish. So far as we know, the northernmost of all previous records for the albacore is the somewhat doubtful one given by Thompson (CALIFORNIA FISH AND GAME, Vol. 5, No. 4, October, 1919, pp. 203-204), for northern California.

Like the striped bass, the albacore made its appearance in large numbers northward of its usual range in 1925 as well as in 1926. The occurrence of albacore in quantity off San Francisco and Monterey in late August and early September, 1925, has been duly recorded in FISH AND GAME (Vol. 11, 1925, p. 185). Whereas they probably ranged northward to central California in greater abundance in 1925 than in 1926 (see Table I), they are not known to have penetrated so far to the northward in the former year as in the latter. Furthermore, a much greater abundance in 1925 than 1926 is also indicated for southern California.

² The following notation has been made at the request of Dr. Hubbs:

The striped bass is now maintaining itself in sufficient numbers at Coos Bay, Oregon, to be of commercial importance. While definite figures are not available, the general opinion of the fishermen is that this fish is increasing in abundance in that region each year. It would seem that the movement of this species to the northward is the normal spreading out of the species following its establishment in the California streams. Its occurrence in numbers sufficient to attract general attention in 1925 and 1926 may have been coincident with, rather than dependent on, the unusual temperatures of these years. If the warmer temperatures played a part in the northward distribution of the striped bass, it has successfully maintained itself thereafter.—F. N. Clark, California State Fisheries Laboratory, April, 1929.

The statistics for the commercial catch of albacore for each quarter year from 1916 to 1926 (Table I), summed for southern and central California, respectively, emphasize the unusual abundance of the species in central California in 1925 and 1926. That temperature plays a part but not the only rôle in this apparent northward migration of albacore along the coast is suggested by the fact that the water temperatures in central California toward the end of the year, when the albacore appear, were higher than usual in 1925, but not consistently higher than in all years, notably 1923, when albacore were not taken in any large numbers so far to the northward (see Fig. 2). What the other factors may be must be left to the staff of the California State Fisheries Laboratory to determine. The run of albacore in central California in 1926 can hardly be attributed to high temperatures at the time of the run, because the water temperatures in the latter part of 1926 were low (Fig. 2). The 1926 run, may, however, have been a holdover from that of 1925, an hypothesis which finds strong support in the unseasonably high temperatures which prevailed over the winter and spring of 1925-1926.

TABLE I

Statistics of Albacore Catch in Pounds for Southern California (South of Pt. Conception) and for Central California (Monterey to San Francisco), for Each Quarter Year from 1916 to 1926, Inclusive)

Year	Southern California	Central California
1916.....	55 405,988 7,614,814 4,605,532	0 0 0 0
1917.....	68,945 2,592,697 25,689,255 1,812,296	0 0 0 0
1918.....	63,278 346,838 7,001,059 25,356	0 0 0 5,123
1919.....	378 652,966 12,224,470 675,130	0 0 0 81
1920.....	3,325 904,121 17,871,575 97,626	0 0 0 0
1921.....	45 2,844 14,751,228 520,411	0 0 0 0
1922.....	0 437,912 12,117,283 676,392	0 0 41 195
1923.....	1,064 207,797 11,908,316 370,873	0 0 0 149
1924.....	0 336,272 16,736,428 207,226	0 0 0 420
1925.....	0 1,331,012 19,684,727 209,374	0 0 79,997 379,832
1926.....	9,935 397,459 1,938,975 4,333	0 0 1,728 116,955

In seeking to determine what significance increased temperatures may have had on the unusual occurrence of southern species north of California in 1926, we find a regrettable lack of any serial records of water temperatures—such as those for Monterey Bay which have served as the basis for figure 2. For indirect indications we must rely on the weather records. In doing this, we assume some positive correlation between varying ocean and air temperatures. In a similar case Thompson has used the mean minimum temperature of the air of coastwise points as an index to the water temperatures (CALIFORNIA FISH AND GAME, Vol. 3, No. 4, October, 1917, pp. 153-159). That the air temperatures along the Oregon-Washington coast were unusually high in 1926 (and also in 1925) has been duly recorded by the U. S. Weather Bureau, in *Climatological Data*. We quote the following from the

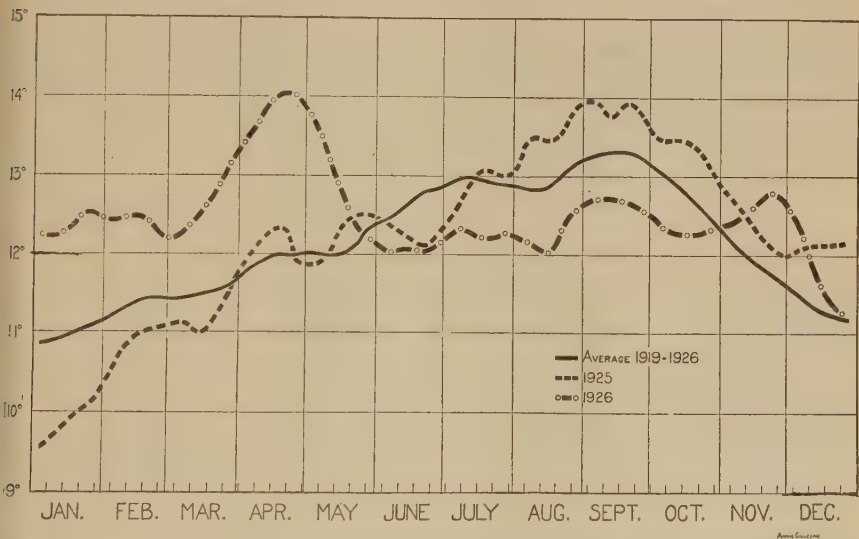


FIG. 81. Ocean temperatures from 1919-1926 in central California. Data taken at Pacific Grove by the Hopkins Marine Station and generously made available by the director, Dr. W. K. Fisher. The daily temperatures, taken off the rocky shore, are averaged by weeks. For the eight-year average the weekly averages are combined. All three trends are smoothed by a running average of five. Degrees centigrade are plotted on the vertical scale against weeks on the horizontal.

summaries as published in that journal. For Oregon, "The annual mean for the state, as shown by the records of 79 stations, was 52.2 degrees. The departure from the normal for 63 stations having ten or more years' record was + 2.5 degrees. For the Western Division the monthly mean was 54.2 degrees, a departure of + 2.6 degrees from the normal of 30 stations having ten or more years' record * * *." The mean average of all the stations in the Western Division, 54.2 degrees, is the highest since the inception of the records in 1891, and is higher by 1.1 degree than the next highest average, which was for the previous year, 1925. For Washington, the 1926 summary informs us that "The mean temperature of the year, 50.8 degrees for the state as a whole was the highest in 36 years of record. Every month except

August, September and December averaged above normal, and September was the only month markedly deficient in temperature. Following a warm December in 1925, the mildness of the winter was unprecedented in the 36 years of state-wide records, the average daily excess in temperature for the five months ending in April being 5.4 degrees for the state as a whole." The year 1925 was also unusually warm in Washington: "The year was remarkable for its high mean temperatures, * * * every month except August, October and November was warmer than the average of previous years, while the mean temperature of the year, 50.7 degrees, equalled the previous high mean of 1906." That these conditions prevailed along the actual coastline, and it is shown that they did in Table II, is especially significant in indicating a high ocean temperature.

TABLE II

Monthly and Annual Departures from the Normal in the Mean Air Temperatures, in Degrees Fahrenheit, for Coastwise Stations in Oregon and Washington, in 1926 (from *Climatological Data*). Stations read South to North. Deviations are Plus unless Indicated as Minus

	Port Orford-----	Marshall-----	Toledo-----	Astoria-----	North Head-----	Aberdeen-----	Forks-----	Port Angeles-----	Port Townsend-----
1925-January-----	1.0	1.9	2.4	3.3	1.3	2.6	3.1	3.2	2.5
February-----	2.4	1.9	3.4	3.9	2.4	6.5	3.3	4.2	3.6
March-----	0.2	-0.8	1.4	-0.6	-0.4	0.7	-0.1	1.7	0.4
April-----	1.4	0.3	1.5	0.5	1.1	1.1	1.2	2.1	1.7
May-----	2.0	1.7	3.4	2.4	2.5	2.7	2.9	2.8	2.6
June-----	1.4	0.7	2.4	-0.4	0.2	-0.8	-0.6	1.5	0.5
July-----	1.1	0.2	-----	-0.5	-0.8	0.2	0.0	1.4	1.2
August-----	-0.9	-0.7	-1.1	-1.5	0.2	-----	-0.2	2.3	1.2
September-----	-0.2	1.2	-0.5	0.3	1.6	-----	-0.5	2.4	0.4
October-----	1.1	0.2	-1.1	0.4	0.9	-----	-1.7	0.5	-0.7
November-----	0.4	-----	-0.3	0.0	0.0	1.4	-0.2	2.3	0.8
December-----	2.8	3.0	3.6	3.8	4.3	4.0	6.0	4.5	3.8
Annual-----	1.1	-----	-----	1.0	-----	-----	1.1	2.4	1.6
1926-January-----	2.7	1.8	1.8	3.0	3.7	2.6	4.2	4.9	3.3
February-----	4.1	4.1	4.4	4.8	4.4	4.1	4.8	6.0	4.8
March-----	5.2	4.3	5.2	5.4	4.8	4.7	4.1	4.6	4.9
April-----	4.7	5.6	6.8	5.8	5.9	6.4	5.0	5.7	5.5
May-----	3.5	3.0	2.5	0.8	2.9	1.7	0.2	1.7	2.1
June-----	-----	1.9	4.0	1.9	1.4	0.8	1.2	3.5	3.4
July-----	-----	1.4	1.2	-0.5	0.8	0.9	0.5	3.6	2.1
August-----	-----	2.1	2.1	-0.7	1.1	-1.0	-0.2	1.5	0.5
September-----	-----	-1.1	-1.8	-2.4	1.5	-1.7	-2.9	0.4	-0.4
October-----	-----	3.0	-0.7	0.6	3.3	1.4	1.3	3.6	3.1
November-----	-----	4.4	2.3	2.2	3.4	0.7	4.0	4.1	3.4
December-----	-----	0.6	0.4	-0.8	-0.1	-0.3	1.2	1.2	0.7
Annual-----	-----	2.6	2.4	1.7	2.8	1.7	2.0	3.3	2.8

The warm temperatures in Oregon and Washington during the first half of 1926 were certainly not local, for temperatures above normal prevailed during this period over a considerable part of the country, in an area extending southeastwardly from the Northwest coast (see temperature maps in *Climatological Data* for 1926).

The unusually warm weather of 1926 along the coast almost certainly would reflect an increased ocean temperature—unless the wind direction was distinctly unusual. A tabulation of the prevailing wind direction during each month over the ten-year period ending with 1926, for the coastwise stations of Washington, shows in most cases a normal

or nearly normal direction was recorded, although in some instances prevailing winds from a warmer quarter than usual actually were recorded. Unfortunately, no air-temperature or wind-direction records are available for Monterey, where the ocean temperatures were taken. At San Francisco, however, the air temperatures were above normal in every month of 1926 through August, excepting January. In most of those months, the wind direction reported was that usually indicated for the ten years previous to 1926.

The midsummer coastwise air temperatures in 1926 were not unusually high; in fact were often below normal. The unusually warm temperatures covered the period from December in 1925 through May, 1926. During this period it is almost certain that the ocean temperatures were unseasonably warm in Oregon and Washington, just as they were at Monterey (Fig. 2).

The unusual northward occurrence of southern forms of marine life along the Pacific Coast in 1926 we think may be attributed to the warmth of the preceding winter and spring, following the rather warm summer of 1925. The southern forms which had wandered northward in 1925 were probably able to maintain themselves to an exceptional degree over the unprecedentedly warm winter of 1925-1926, and then rapidly spread northward during the spring, when the ocean temperatures were verily summer like.

RECENT LEGISLATION

The forty-eighth session of the California legislature had before them for consideration 120 bills relating to fish and game. Only 27 of these bills became laws. Practically no changes were made in the open seasons for the taking of game nor in the bag limits, the legislature apparently having concluded that in this respect our California statutes were satisfactory.

The following is a list of senate and assembly bills receiving the signature of the governor:

Senate Bill No. 27—Adds four new refuges:

1R in Tuolumne County; approximately 90,000 acres.

1S in Lassen County; approximately 40,000 acres.

1T in Humboldt County; 1,920 acres.

3H in Santa Barbara County; approximately 15,000 acres.

Senate Bill No. 49—Classes domestic cats as predatory animals in game refuges. Allows deputies and employees of Fish and Game Commission to kill any cats that are at large. Cats that are in the residence or upon the grounds of its owner are exempt from the provisions of the act.

Senate Bill No. 267—Allows the taking of fur-bearers by use of dogs.

Senate Bill No. 270—Provides that the Trapping License Act should not apply to Districts 2, 2½, 4 and 4½.

Senate Bill No. 287—Prohibits the use of saw tooth or spike jaw traps for taking fur bearers.

Senate Bill No. 317—Prohibits hunting of ducks, geese and jacksnipe in Districts 4, 4½, 42, 4c, 19, 20, 20a, 21 and 22, except on Wednesdays, Saturdays, Sundays, legal holidays, and the opening and closing day. Allows the hunting of waterfowl in 4a on these days only between 8 a.m. and sunset.

Senate Bill No. 393—The owner of growing or harvested crops that are being damaged by game can call in a regular game warden who shall, to the best of his ability, attempt to stop such damage.

- If impossible to do so he may kill the animals causing the damage.
- Senate Bill No. 403—Strengthens the commercial gun club act by providing that the license may be revoked if the owner aids and abets or acquiesces in violations of the game laws on the part of his employees or guests.
- Senate Bill No. 434—Sardine Reduction Act.
- Senate Bill No. 572—Allows the use of crab nets in District 1½. Changes the season for barracuda from the 16th day of May to the 1st day of May.
- Senate Bill No. 585—Provides for the punching of a brand in the tail of domestic fish in lieu of the metal tag required in the old law.
- Senate Bill No. 731—Provides that a deer may be taken from an open into a closed district when the tag is countersigned by a Justice of the Peace, any fish and game deputy, notary public, postmaster, peace officer, or an officer authorized to administer oaths.
- Senate Bill No. 760—Changes the boundaries of many game refuges from section lines to ridges, streams and roads. Creates four new refuges: 1R, 1S, 1T and 3H. Moves Refuges 1F and 4F to better locations. Moves the east line of District 1½ from the east line of Siskiyou County to the Southern Pacific railroad and the Klamath River. Creates District 18A, a special district for Pismo clams, in San Luis Obispo County.
- Senate Bill No. 808—Allows the possession of venison for 15 days after the close of the season.
- Senate Bill No. 880—Grants to the government the right to establish waterfowl refuges in accordance with the new Federal Act.
- Assembly Bill No. 6—Changes trout season in District 4½ to open May 1st. Prohibits possession of any gaff, except a landing gaff, adds Eel River to District 2 to the streams which are to be fished during November, December, January and February. Allows the shipping of trout from an open to a closed district by having a statement countersigned by the agent of the company to whom offered for shipment. Prohibits sale of all steelhead in District 1½.
- Assembly Bill No. 59.—Changes crab season in Humboldt County waters to August 31st to December 14th, inclusive. Delays one month on both ends.
- Assembly Bill No. 60—Prohibits taking of any clams in District 18a in San Luis Obispo County. Puts limit of 15 Washington clams in District 10. Puts limit of 10 mussels per day in Districts 18 and 19. Puts a limit on abalones of 10 per day, 20 per week in District 7. Prohibits diving for abalones in District 7.
- Assembly Bill No. 284—Creates an invertebrate refuge of the property of the Scripps Institution of Oceanography, in San Diego County.
- Assembly Bill No. 303—Adds Districts 1½, 2½ and 4½ to the district in which it is unlawful to take game fish at night.
- Assembly Bill No. 320—Provides that the opening of the salmon season in District 5 is 15 days earlier and the closing of the season in this district is 30 days earlier. Provides a uniform trolling season for all outside ocean districts from the California-Oregon line to the northern boundary of Ventura County, with the season opening on June 1st and closing September 15th. Provides no change in the present law for tidewater of Klamath River, nor commercial fishing in Districts 12 and 12B, which take in the Sacramento-San Joaquin rivers. Prohibits the taking of fish in the ocean waters within 3 miles of the mouth of the Klamath River.
- Assembly Bill No. 325—Creates a quail refuge in and around the town of Bolinas, in Marin County.
- Assembly Bill No. 337—Adds crow and black-billed magpie to the list of predatory birds.

- Assembly Bill No. 421—Makes it unlawful to drive any game bird by means of auto, power boat or airplane over hunters with the intention that the birds shall be shot at.
- Assembly Bill No. 480—Prohibits the taking or possession of crayfish in District 4.
- Assembly Bill No. 646—Creates a game refuge around General Grant Park.
- Assembly Bill No. 1119—Allows the private stocking of streams and other waters by purchase of fry from private hatcheries under permission of Fish and Game Commission.

In addition to the above, there were two resolutions adopted by the senate. One, appointing a committee of three assemblymen to investigate fishing conditions on the Klamath River and to report to the next session on the advisability of the state purchasing the cannery at Requa, in order that commercial fishing might be prohibited upon this magnificent river.

The other resolution asked for the appointment of a committee to make a special study and detailed investigation of migratory wild fowl and the influences that affect the supply; and whether private sanctuaries are harmful or beneficial; and to gather information from federal and state sources regarding conditions in other parts of the United States and Canada and to report back to the next session of the legislature.

DISEASE PREVENTIVE MEASURES FOR GAME FARMS

Many game keepers have become discouraged in raising game birds because they have experienced great losses from diseases. To prevent and combat disease outbreaks, one must consider the predisposing factor which is faulty management. This includes the selection of weak and diseased stock, improper handling and feeding, and poor sanitation. The following measures should be employed in the proper manner which will help to maintain disease-free stock.

1. Select stock from a source which has a clean health record.
2. All new birds introduced onto the premises should be held in quarantine, and kept under close observation for manifestations of disease.
3. Only vigorous and healthy birds should be employed for breeders.
4. Breeding and rearing pens, brooder and rearing coops should be so constructed that they can be easily cleaned and disinfected at frequent intervals.
5. Overcrowding in the pens should be avoided.
6. A rotation system of pens should be practiced so that the ground can be disinfected, plowed and rested.
7. In using domestic hens, they should be selected from disease-free flocks because poultry diseases are often transmitted to game birds through domestic stock.
8. Domestic poultry maintained on the premises should be subjected to tests and treatments for such diseases as bacillary white diarrhea, tuberculosis, internal and external parasites.
9. With regard to handling and feeding game birds, one should consult an experienced successful breeder for information and advice.
10. Diseased or dead specimens should be sent for examination to the Fish and Game Laboratories, George Williams Hooper Foundation for Medical Research, University of California, San Francisco, California.

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September 23, 1929

"Take only the natural increase; the interest is ours, but the principal belongs to posterity."

STREAMS CLOSED TO FISHING, 1929

A number of fishing streams were ordered closed to fishing last year as a result of action taken at the 1927 session of the California legislature. Vested with proper authority, Governor C. C. Young and Fred G. Stevenot, Director of the Department of Natural Resources, have taken similar steps this year. Consequently a number of additional fishing streams and lakes in various sections of the state are closed to all fishing.

This action was taken only after careful investigation to protect spawning areas in certain sections. It also came as the result of many requests by fish and game protective and sportsmen's organizations that certain other waters be closed to fishing as a conservation and protective measure.

The only streams closed last year that have been opened for fishing this season are Santa Rosa, Mark West and Salmon creeks in Sonoma County, Deer Creek in Tulare County, and Bear Canyon Creek in Los Angeles County.

The list of closed waters follows:

Coast Counties—

Humboldt County: Yager, Anderson and Dobbin creeks and all tributaries; Prairie Creek and all tributaries to its junction with Redwood Creek.

Lake County: Willow, Rice, Deer, Trout, Soda and Salmon creeks and all tributaries.

Santa Cruz County: All waters after August 1st, except tidewater.

Sacramento River Watershed—

Lassen County: Snag Lake and tributaries.

Shasta County: Grassy Lake and stream connecting with Snag Lake; Hazel and Shotgun creeks and tributaries.

Plumas County: Thompson, Tollgate, Blackhawk, Clear and Rock creeks and

tributaries, all in vicinity of Quincy; Red Clover Creek (a tributary of Indian Creek) and tributaries; Butt Creek between the Almanor Tunnel and Butt Lake. (Butt Creek, listed above, closed ONLY from Nov. 1 to May 29.)

Plumas and Sierra Counties—

Streams flowing into Gold, Grassy, Jamison, Smith, Long and Round lakes for a distance of 2,000 feet up stream from the mouths, the outlets of these same lakes for a distance of 2,000 feet from the lake and that part of the lakes within 300 feet of the outlet will be closed until August 1, 1929. All of these lakes are located in the Mt. Elwell country near Blairsden.

Siskiyou County—

Soda Creek and tributaries.

Eldorado County—

Rainbow, Grouse, LeConte, Waca, Pyramid, Gefo, Toem and Jabu lakes.

Placer County—

Bunker Lake.

Tahoe and Truckee River Watershed—

Martis (a tributary to the Truckee), Alder (a tributary of Prosser Creek), Sage Hen (a tributary to the Little Truckee) and all tributaries. Griffs, Slim Jim, Burton, Ward, Blackwood, Madden, McKinney, General, Meeks, Lonely Gulch, Rubicon, Eagle, Cascade, Taylor, Upper Truckee, Trout, Cold creeks and all tributaries; all of the above flowing into Lake Tahoe.

San Joaquin Basin Watershed—

Fresno County: All streams flowing into Shaver Lake. All tributaries to Dinkey Creek.

Tulare County—

McIntyre, Boulder, Bear creeks and tributaries. Coy Creek above Rogers Camp trail; Lost Meadow Creek above Loyd Meadow trail; North Fork of Tule above Redwood Crossing; Alder Creek (tributary of the North Fork of Middle Fork of Tule River); Kern River and big Kern Lake between Horse Trail Bridge and the outlet of Big Kern Lake; Brush and Tobias creeks and tributaries.

Southern California—

Los Angeles County: Devil's Canyon Creek and tributaries.

Orange County: Holy Jim Creek and tributaries.

Mono and Inyo Counties—

Middle Cottonwood Lake and stream connecting with lakes above and below. Reverse Creek and tributaries between June Lake and Rush Creek.

CONVENTION OF VOLUNTEER WARDENS

On April 27, 118 volunteer deputies of the division gathered in San Francisco at their own expense for intensive instruction and open discussion of conservation and protection problems. The occasion was the first state-wide convention of volunteer game wardens ever to be held, and it brought together men from as far north as Humboldt County and as far south as Los Angeles.

Following registration at headquarters of the division in the Russ Building, the volunteers gathered in the Merchants Exchange Building, the convention proper starting at 1.30 in the afternoon and operating on a strict time schedule until 4.30 when the meeting was thrown open to discussion from the floor. R. M. Grose, captain of the volunteers in the San Francisco district, presided. John L. Farley, executive officer of the division, greeted the men and praised their efforts. He was followed by E. L. Macaulay, chief of patrol; Walter R. Welch, captain in charge of volunteer deputies; S. B. Show, United States District Forester; and George Tonkin, federal game protector. Following a brief intermission when the men fraternized with one another, Dr. Harold C. Bryant, in charge of the Bureau of Education and Research, addressed the convention, after which short talks were given by Donald McLean, field naturalist, on hawks and owls; J. S. Hunter, assistant to the executive officer, on game refuges; and John Spencer, head of the hydraulic bureau, on screens and ladders.

The open discussion which followed brought out many interesting problems both as to law enforcement and the various things that come up in the work of a game warden. A fine spirit was shown and throughout the entire proceedings one could see that the volunteer force is cooperating fully with the regular patrol.

The convention closed with a banquet served in the Commercial Club where after a brief introduction Captain Grose turned the meeting over to Captain Welch who introduced Albert Lindley, well known conservationist of Stockton, California, who acted as toastmaster. Lindley proved to be the ideal man for the occasion and in an adept and happy manner put all of the speakers at ease and brought out many good laughs.

Those addressing the diners included: President I. Zellerbach, who praised the organization and expressed his appreciation of the work done; police judges J. L. Steiger and Sylvan Lazarus; Senator Sanborn Young, chairman of the Senate Committee on Fish and Game; Fred G. Stevenot, director of natural resources; M. B. Pratt, state forester; Executive Officer John L. Farley. Former Executive Officer Eugene D. Bennett, paid his respects to the men whose organization he had assisted in forming while chief of the division. All those speaking declared a full realization of the importance of the meeting and of the work

being done by this fine body of volunteer protectors of the wild life of the state.

CALIFORNIA'S FISH CATCH

California's fresh fishery products lead the world. The coast fisheries probably unknown to many, have been for many years the basis of one of the greatest of the industries of the Golden State, but it remained for the startling increase in 1928 to show world leadership with a production of over half a billion pounds of fish, 528,481,044 to be exact. This figure shows an increase over the production last year of 104,113,862 pounds.

Sardines, as usual, lead, with 420,269,665 pounds as against 342,275,289 during 1927. There was great increase in the production of mackerel due to the greatly increased activity in the canning of this fine food fish. The 35,251,298 pounds taken in 1928 place it in second place. This was an increase over 1927 of 30,522,395 pounds.

Third on the list is bluefin tuna with 13,700,870 pounds. In 1927, 4,898,386 pounds were considered an excellent record. Sole is in fourth place with 10,280,419 pounds; rockfish, fifth, with 6,414,971; salmon totaled 4,478,566; barracuda, 4,385,214; skipjack, 4,262,732; abalones, 2,066,243; bonito, 1,317,963; herring, 1,139,682; halibut, 1,308,053 pounds.

Pompano totaled 3295 pounds and pike 3780 pounds, while 1029 pounds of suckers were caught also. In the Sacramento-San Joaquin district 168 pounds of terrapin were taken, and eels with 227 pounds remained the smallest figure on the list.

The Monterey County district leads the state with 229,123,321 pounds of fish, due to the enormous sardine catches brought in, while the Los Angeles district with 217,466,068 pounds is second. This district produced 29,872,267 pounds of the big catch of mackerel. The San Francisco-San Mateo district with 44,294,407 was third; San Diego-Imperial, 20,024,176, fourth; Santa Cruz, 3,512,722, fifth; Marin, 3,068,040, sixth; Del Norte-Humboldt, 2,420,162, seventh; Alameda-Contra Costa, 2,377,250, eighth; Mendocino-Sonoma, 2,168,520, ninth; and Orange, 1,821,510, tenth.

The Solano-Yolo district was low, but accounted for 514,553 pounds of fish included in the record breaking total for the state during 1928.

The crabs taken numbered 148,927 dozen; Pismo clams totaled 125,205 pounds and shrimps 2,280,871 pounds.

In addition to this record California catch the total of fish brought from south of the International boundary into San Diego was 26,040,412 pounds. Another 23,730,871 pounds came into the port of San Pedro. Yellowfin tuna was the largest item in this catch, a total of 32,168,580 pounds coming into the two ports.

FEDERAL GAME DEPARTMENTS CONSOLIDATED

In the interest of efficiency and economy, the Division of Game and Bird Reservations has been consolidated with the Migratory Bird Treaty and Lacey Acts, Division of the U. S. Department of Agriculture, Bureau of Biological Survey. The new division will be known as the Division of Game and Bird Conservation. The division will have under its immediate direction the following major activities:

Enforcement of the Migratory Bird Treaty Act and regulations.

Enforcement of the Lacey Act, prohibiting the interstate shipment of common carrier of the dead bodies or parts thereof of wild animals which have been illegally killed or which are shipped contrary to the laws of the state from which shipped.

Enforcement of section 84, as amended April 15, 1924, protecting wild animals and birds and their eggs on federal refuges.

Maintenance of the federal big-game and bird reservations under the jurisdiction of the U. S. Biological Survey and the establishment of additional ones as they may be authorized from time to time by congress, including the Upper Mississippi River Wild Life and Fish Refuge authorized in 1924, and the Bear River Migratory Bird Refuge under the act of April 25, 1928.

Exercise of the functions delegated to the Biological Survey under the Alaska Game Law and cooperation with the Alaska Game Commission in its activities.

The official title of the head of the new division—Colonel H. P. Sheldon, Washington, D. C., will be U. S. game conservation officer. The title of each U. S. game warden will be changed to U. S. game protector and of each reservation warden to U. S. reservation protector.

BIOLOGICAL SURVEY FORMS NEW DIVISION OF LAND ACQUISITION

Secretary of Agriculture Hyde has authorized the creation in the Bureau of Biological Survey of a new unit, effective July 1, to be known as the division of land acquisition. This new activity is

authorized by an act of congress, approved February 18, 1929, known as the Migratory Bird Conservation Act. Its purpose is to meet more effectively the obligations of the United States under the Migratory Bird Treaty with Great Britain by lessening the dangers threatening wild fowl from drainage and other causes, through the provisions of areas of land and of water to furnish in perpetuity reservations for their adequate protection through acquisition by purchase, gift, or lease. The field of work will extend throughout the United States, including Alaska.

In order to carry out the purposes of the Act it is necessary to ascertain by examination of the numerous potential areas to be found throughout the United States those that are best adapted for refuges, to make appraisals in order to determine their character and value, and to conduct other activities incident to their acquisition with the funds made available by congress from time to time.

The units selected for migratory bird refuges must be of such character as will best serve the purposes contemplated under the act. Usually they will be more or less extensive areas of lowland, comprising marsh and woodland contiguous to or embracing water areas, or they may be areas that were formerly well suited as feeding and nesting grounds for migratory birds, but now useless by reason of drainage developments or evaporation and subject to restoration to their natural conditions. The Migratory Bird Conservation Commission created by the act will consider and pass upon all lands recommended by the Biological Survey for acquisition for refuge purposes. The Secretary of Agriculture is chairman of the commission.

In addition to having charge of the land acquisition under the Migratory Bird Conservation Act, the new division will supervise all other land acquisition and cadastral survey activities of the Bureau of Biological Survey, including the Upper Mississippi River Wild Life and Fish Refuge and Bear River (Utah) Migratory Bird Refuge.

The new division of land acquisition will be directed by Rudolph Dieffenbach, senior land valuation engineer, who has been conducting work incident to the acquisition of lands on the Upper Mississippi River Wild Life and Fish Refuge and elsewhere for the Survey since 1925.

STATES CONSENT TO ACQUISITION OF LANDS FOR FEDERAL MIGRA- TORY BIRD REFUGES

Since the approval of the Migratory Bird Conservation Act on February 18,

1929, two states, Kansas and Montana, have given consent to the acquisition of lands by the federal government for refuge purposes under the new law, according to information received by the Bureau of Biological Survey of the United States Department of Agriculture, which will administer the act. Section seven of the Migratory Bird Conservation Act provides that no deeds shall be accepted by the Secretary of Agriculture unless the state in which the refuge area lies shall have consented by law to the acquisition by the United States of lands in that state. The Kansas Enabling Act was approved on February 26 and the

quired, a draft of a suitable measure has been prepared for consideration by the state legislatures holding sessions this year.—*The American Field*, April 20, 1929.

FIRST DISCOVERY OF SARDINE EGGS

After a search which has extended over a long period of time, and covered the entire coast of California from Eureka to San Diego, E. C. Scofield, scientific assistant in the bureau of commercial fisheries of the division finally located large numbers of sardine eggs and larvae five miles off Point Vincent in southern California the first week of June, 1929.



FIG. 82. A limit of rainbow trout taken in Lake Elinor, Yosemite National Park, opening day, 1928. Photograph by H. P. Walls.

one in Montana on March 1. These two states are the first to take special action in the matter, although it has been determined that existing legislation in the states of Arizona, Colorado, Connecticut, Georgia, Illinois, Iowa, Louisiana, Maine, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, South Carolina, South Dakota, West Virginia and Wyoming is sufficient for the federal government to proceed with the acquisition of areas for refuge purposes. State enabling legislation, however, will be necessary in all other states. In those states where legislation in harmony with the federal act is re-

The discovery is the first of its kind made in America. Its importance is far reaching and, no doubt, will lead to other discoveries that will give information regarding the spawning habits of the sardine. Aside from its scientific value, this knowledge will be of very practical benefit to the sardine canning industry.

Fishermen know that just before sardine eggs are ripe and the fish ready for spawning, the fish disappear. They have never been able to locate their spawning areas. After the eggs are deposited the sardines reappear and can be taken by the fishermen. Scofield found schools of sardines apparently spawning and was

able to secure eggs and larvae for scientific investigation. The eggs found were almost entirely transparent. Apparently, they hatch floating in the water, and the transparent condition is nature's method of protecting them from their natural enemies.

The discovery will always remain a feature of the hydrobiological survey. This survey is a cooperative investigation with the Hopkins Marine Laboratory of Stanford University and the Bureau of Commercial Fisheries of the division. Its objective is to assist the canners and fishing interest in learning something of the habits of the sardines and the effect of hydrographic conditions on the movement of the sardine in California waters.

VOLUNTEER DEPUTY INJURED

On Sunday morning, April 28, volunteer deputy Lee Straight was seriously injured. He was making an adjustment of the motor of one of the bay and river patrol boats preparatory to a search for illegal net fishermen. While thus engaged, his revolver fell from the holster and discharged a bullet, which entered the left side of his body passed through the intestinal portion and penetrated a lobe of the liver.

Volunteer deputy Straight has rendered invaluable service to the department and this accident was considerable of a shock to many of his friends and brother officers. It is a pleasure to record that he has passed the critical stage. The hope of a speedy recovery goes out to him from all associated with the division.

HUNGARIAN PARTRIDGES TRANSPORTED BY AIRPLANE

California was perhaps the first state to use an airplane in transporting game birds from the holding pen to the fields for liberation. This was made possible by Commissioner George B. Clarkson and the Standard Airways Company of Los Angeles.

On the trip from Los Angeles to Victorville, on April 8, an altitude of 8000 feet was reached and this is possibly the high altitude record for Hungarian partridges. The birds showed no ill effects of the trip or even the high altitude.

PERPETUATING A NATURAL RESOURCE

Modern methods of game administration look ahead and give heed to the needs and pleasures of generations to come. They recognize those means that best insure a continuous supply for the future. Gold and iron, oil and coal, represent a class of natural resources capable

to complete exhaustion with continuous use. Wild life resources, on the other hand, are able to reproduce themselves and typify a natural heritage that may be made perpetual. Any intense exploitation or over use of a wild life resource will, of course, result in its depletion, so that any prolonged or lasting benefit which it is capable of giving can only be gained by wise use over a long period of time.

The objective sought by the Division of Fish and Game is a system that will maintain the state's wild life resources in the face of a progressive civilization, but in harmony with the economic necessities and social requirements of a rapidly increasing population. The attainment of this object is dependent, first, upon husbandry of wild life in existing remnants of wilderness areas or adjustment in other areas where the natural environment has been changed or modified to bring about suitable conditions for wild life survival; second, replacement of depleted game covers and barren streams by thousands of artificially produced individuals.

Obviously only those methods which experience has proved effective should be employed to accomplish this object. Laws regulating the killing of game and the taking of fish represent one of the early methods used to conserve fish and game. As early as 1852, California gave legal protection to certain valuable game mammals. Through the years the state has continued to restrict hunting and fishing and to prohibit the use of methods whose practice has proved inimical to the preservation of wild life. At present the division has 122 regular deputies patrolling every section of the state to enforce fish and game laws. This regular patrol is considerably assisted in its work of protection by some 850 volunteer deputies.

Any system that would wisely conserve game mammals and birds must recognize that shooting is only one of the many factors responsible for the reduction of game. No species of animal life can endure without food, water, shelter, safety from enemies and adequate breeding grounds. It should seem self-evident that elk can not live in a country where the progress of agriculture has appropriated their natural pasture; neither can deer survive on land blackened and devastated by fire where food, water and cover are absent. Similarly, upland game birds can not reproduce their kind when their nest sites have been destroyed by destructive lumber or forest denudation. It is impossible for wild fowl to carry on when

reclamation projects have dried up their homes.

In other words, if the continuance of a species is to be made sure, these so-called "biological requisites" must be taken into account. Smaller bag limits, shorter seasons and other legal restrictions are not in themselves thoroughly effective remedies for disappearing game birds and mammals. In recognition of this fact the division has established a chain of game refuges extending throughout the length and breadth of the state. These 34 state game refuges embrace about 2,372,350 acres of forest lands where natural conditions are modified to the least possible degree by human influence and where natural food and breeding sites suitable to the type of game conserved are available.

The new hunting license act provides that one-third of all the revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds. Already the division is availing itself of the opportunity to obtain sanctuaries for migratory wild fowl to equalize the condition caused by the loss of feeding and loafing grounds through the drying up by reclamation of former flooded areas.

Besides employing effective and advanced methods of protection the division is actually engaged in the production of game fish and game birds. It owns and operates twenty-six hatcheries and twelve egg-collecting stations. Its fish-cultural equipment enables it to plant yearly from twenty to thirty-five million trout and salmon in the 26,000 miles of fishing streams in the state. The hatchery at Mt. Shasta is alone capable of producing 10,000,000 trout.

The division maintains at Yountville, Napa County, a ten-acre game farm where pheasants, quail and partridges are raised for liberation in depleted covers. In 1928, 6106 Chinese ring-necked pheasants were liberated in suitable areas. Another game farm, now built in southern California, will make possible the liberation of many more thousands of pheasants.

In short, the division is vigorously putting into practice a system of game management embodying those methods which best insure its object to make hunting and fishing an asset to be enjoyed for all time in California.

SALMON CONSERVATION

One of the chief matters of interest to the International Pacific Salmon Investigation Federation is the effect of trolling on the salmon supply. Large

numbers of salmon have been caught and tagged. The most interesting result of the tagging experiment is that salmon from streams in Washington and Oregon, and even from the Sacramento River, seek feeding grounds in the north Pacific. These are caught by trollers operating off British Columbia.

For the last eighteen years, attempts have been made in British Columbia to accord protection to sockeye salmon in the Fraser River which are being overfished in Puget Sound. If this treaty is entered into which will safeguard the salmon of the Fraser River, Canada will be in a position to give more attention to the need of restricting trolling. For this reason, the division is much interested in the treaty now before the Canadian Parliament. This treaty is between Canada and the United States and proposes to establish an international commission with power to investigate and to make restrictions in an attempt to reestablish the once great runs of salmon of the Fraser River and Puget Sound.

The treaty has been signed by the state departments of both governments. Its ratification by the Canadian Parliament will remove a very definite barrier and pave the way for further measures to be taken to conserve the salmon of the Pacific coast.

WHO OWNS THE GAME?

The ownership of game often affords a lively topic for argument. Probably the most familiar theory advanced is that the owner of land, since his property supplies the necessary requisites for the existence of game, has a proprietary interest. At times this interest approaches a claim of almost complete and absolute ownership. A second popular holding is that game belongs to the sportsman. This contention arises because the sportsman can trace the fee which he pays for the privilege of hunting and fishing and can say that it is his money which is used to produce and protect game.

A recent decision by a supreme court in Missouri on this question concurs with the accepted theory of most states. The court in this case again asserted that game belongs to the state. It belongs to no individual until it has been reduced to possession by taking in the manner prescribed by law.

Montana Wild Life for March, 1929, quotes pertinent paragraphs from this decision, *State of Missouri vs. Savage*: "The ownership of wild animals so far as they are capable of ownership is in the state, not as a proprietor but in its sovereign capacity as the representative

and for the benefit of all its people in common. It is therefore the duty of the legislature to enact such laws as will best preserve the subject of the trust and secure its beneficial use in the future for the people of the state.

"The license issued to the defendant authorizing him to hunt and kill, subject to the regulations and restrictions of the law. This is a reasonable police regulation to prevent evasions of and for the effectual enforcement of the act; the defendant had no interest whatever in the quail that he may have taken; he simply had a privilege to kill or have in his possession a limited number on any one day. He has accepted his license under the terms, restrictions and limitations of the law and consented in advance that the game warden might at any time count the quail in his possession and that such inspection and count of quail in the defendant's possession is not an unreasonable search and seizure and such requirement is a reasonable and necessary regulation for the enforcement of the statute."

Further quotation from the decision: "The defendant by taking out a license to hunt and kill game, the title to which was in the state, acquired a mere privilege to hunt, subject to the restrictions and limitations of the statute; that the statute requiring him to permit the game commissioner or his deputies to inspect and count the fish, birds, animals and game in his possession to ascertain whether the requirements of the statute were being faithfully complied with, is a proper and necessary police regulation to discover and prevent easy evasions of the statute. The statute being of general application to all persons alike, is not repugnant to the due process and equal protection clauses of the constitution. By accepting a hunter's license he waived the constitutional rights involved so far as applicable to the facts in this case."

PROPOSED CHANGE IN OPENING OF TROUT SEASON UNSATISFACTORY

For many years past, anglers have complained that the fish caught in Inyo, Mono and Alpine counties at the first of the season were full of spawn. An attempt was made to give safety to spawning fish by means of a later opening of the season. A change from May 1 to May 30 would have caused great dissatisfaction, though giving protection to the fish in a section rapidly growing in favor of recreation grounds. So adverse was sentiment that the bill failed to receive sanction.

FISH RESCUE AND RECLAMATION

A most constructive conservation measure has been undertaken by the division recently in the establishment of a Bureau of Fish Rescue and Reclamation. Its purpose is to rescue and reclaim the millions of young and adult game and food fishes annually lost to the state by becoming stranded in the flooded areas adjacent to the many streams and lakes, and from streams that would become dry by reason of a minimum of snow or rainfall.

Heretofore, owing to the lack of funds, but little effort was made to rescue but few of the millions of fish lost in this way.

In addition to the salmon, trout and nongame catfishes there are six species of fresh water game fish for which a state license is required to take them. They are the striped bass, black bass, crappies, sunfishes and perch. None of the above with the exception of the Sacramento perch are native to California but of great commercial food value. They are natives of New Jersey, Vermont, Michigan, Illinois and midwestern states. They are known as the spinous or spiny-rayed fishes and unlike the salmon and trout, do not require flowing current of water to hatch their spawn, with the possible exception of the striped bass. These fishes seek ponds, sloughs, lakes and overflowed areas containing weeds, grasses, moss and other aquatic growth in which to spawn and which furnish algae for the young and protection against some of their predaceous parents.

Like some of the trout species transplanted into our waters from other states and foreign countries they have proved very adaptable to the aquatic conditions of California. The numerous streams, and lakes furnish an abundant food supply for them. This together with the mild winters enable them to reach a larger size than in their native waters from whence they came.

The flooded lands adjacent to the streams of the valley, particularly the San Joaquin, Kings, Cosumnes, Mokelumne, Sacramento and American rivers furnish many thousand acres of natural spawning grounds so necessary for their propagation, but which become dry in the early summer. Their propagation costs nothing. Their hatcheries are the swamps and sloughs. They require no feeding as do artificially hatched fish, no buildings or attendants, no watchful eye of fish-culturists. Nature does it all, except that when nature has completed its wonderful work, the young and adult

fish must be removed to permanent waters and not allowed to remain a prey to the numerous predatory birds and animals. This is the purpose of the bureau.

Heretofore few replacements have been made, while millions have been lost every year. Even the few that have been planted can in no sense replace those taken out by the angler. There is no better food or game fish than the spiny-rayed tribe named above, and it is of much importance that a supply be maintained.

An idea of the importance of this new venture, from an economic point of view is shown by the following. In the three months from August 7, 1928, to Novem-

as a game fish as it is in the east and midwestern states, they will be sought for as eagerly as are our trout. Any of the sunfishes, crappies or bass will take the artificial fly or spinner and with trout rod and tackle will afford equal sport with trout both in the catching and eating qualities.—George Neale.

ANNUAL DEER CROP

Minnesota claims the largest bag of deer in the United States for the year 1928. Sportsmen there made a record kill of 27,335 legal bucks. Pennsylvania had an open season on does which were very abundant and even then did not



FIG. 83. A three-pound Lake Almanor rainbow trout. Photograph by E. S. Cheney, May 15, 1929.

ber 7, 1928, this bureau saved to the state 862,251 fresh water fishes and returned them to the water alive. Of these, 122,475 were striped bass from four to six inches in length. In one year, these fish will weigh approximately 16 ounces and when they attain the size of three pounds each, would sell for 25 cents or 30 cents per pound. This species grow to as much as 50 to 75 pounds in our waters. In addition to the game fishes rescued the bureau has saved 278,260 catfish, not classed as a game fish but of extreme commercial value, and will sell for the same price as striped bass.

When the anglers of California appreciate the value of the spiny-rayed fishes

exceed this kill in Minnesota. California ranks third with a kill of 21,515.

The deer kill in three of the most densely populated eastern states is quite remarkable from a certain point of view. Contrary to popular opinion, it is not necessary to repair to the wilder and less settled parts of the nation to find certain types of game fairly common. In fact, some game species seemingly thrive in the face of modified conditions brought about by the encroachment of civilization. They possess a ready adaptability and are quick to avail of advantages. Partial encroachment in the east seems to have created conditions highly favorable for the survival of white-tailed deer. For

instance, New York, New Jersey and Pennsylvania have a population of 25,000,000 people or 243 person to the square mile. Yet statistics for 1928 show that hunters legally bagged 7029 male deer in New York, and 1415 in New Jersey, while in Pennsylvania 25,097 females were legally taken.

The area of California is twice as great as these three states combined. However, it must be borne in mind that the black-tailed and mule deer are the predominating species in the state. These species, as yet, have not succeeded in holding their own where the encroachment of civilization has modified the old natural order. So far the range of the white-tailed deer covers but a small area of the Modoc region. In a sense, it is but a winter visitant, for it is not definitely known that the animal breeds in the state.

SAFETY OF MIGRATORY FISH THREATENED

In recent years a critical situation has arisen in the western states. Power dams at first largely restricted to the upper reaches of streams in the mountains are now being built at lower points. There is dependable evidence that migratory fish, as salmon and steelhead, are blocked from reaching their spawning grounds as a result of these insurmountable obstructions. No satisfactory fishway has yet been devised which will allow fish to pass beyond a 200-foot dam.

The general public, although seldom realizing the grave danger, has made two shows of strength when legislation was necessary. In California, Klamath River was made a fish preserve and high dams are prohibited. In Oregon this past winter, a strong showing was made in the attempt to keep four of Oregon's principal fishing streams free from artificial obstructions.

The 1929 legislature of Oregon passed a law which saves the Rogue River as a fishing stream. The state engineer may no longer grant permits for water appropriation without first taking into consideration the safety of the migratory fish.

Although it seemed that the Klamath River controversy was satisfactorily settled by the referendum, the power company concerned continues to be active. As a further means of putting an end to this agitation, a committee was appointed by the California Development Association. The problems to which the Klamath River Study Committee will devote its efforts are: (1) The harmonizing, if possible, of the views of the

various groups concerned, and (2) the development of a program of future uses of the river that will serve the best interests of the state. After making a thorough inspection of the area in question, a series of public hearings have been held. There has been evidenced a fine spirit of fair play to both sides and a worthwhile report is to be expected.

TROUT FOOD

A novel method for securing natural food for baby trout was used in the vicinity of Clear Lake, Lake County, California, last summer. The device constituted an insect trap designed in the form of a funnel-shaped cloth sack over which was suspended an electric light. These traps were hung near the water and the light left burning during the entire night. Several hundred pounds of insects were gathered each week in this manner and collected and fed to the young trout in the Cold Creek Hatchery near Ukiah.

J. W. Ricker, who carried on the experiment, reports that the captured insects afforded splendid food, providing other types of food were supplied. The young trout appeared not to do so well unless their diet was varied.

SAN DIEGO COUNTY PAYS BOUNTY ON MOUNTAIN LIONS

On September 1, 1928, the San Diego County Board of Supervisors passed an ordinance to pay a bounty of \$75 for the killing of mountain lions in San Diego County, regardless of sex. Since September nearly twenty-five lions have been killed in the county and there are reports that still some lions are at large.

J. B. Thompson, who had been hunting for the Biological Survey in New Mexico, heard of this county bounty, in addition to the state bounty, and came to San Diego County with his family. He has killed ten lions since May 20 this year, shooting them from trees or other points where they have been driven by the hounds. His dogs are trained for lions, will run nothing else and are skilled in the lion hunting business.

The Goswick brothers from Texas were attracted by this bounty and have four lions to their credit. They have lion dogs, too.

The balance of the lions have been taken by resident hunters anxious to avail of the county's offer.

PHEASANTS HELP FARMERS AND HORTICULTURISTS

Another use has been found for the Chinese ring-necked pheasant. The board

of game commissioners of Pennsylvania has announced that proof has been found that the ring-neck pheasant feeds on Japanese beetles, one of the most serious insect pests found in the eastern United States. The stomachs of numerous birds which have been killed have been examined and found to contain hundreds of these destructive insects.

It has also been shown that the starling, an otherwise unpopular introduced alien bird, feeds on the Japanese beetles. The skunk has also been observed eating the same insects.

The Japanese beetle, brought to America in some imported Japanese plant, has become established in certain parts of the east and has grown to be a most dangerous pest to agriculturists and horticulturists. Its devastations include orchards, vineyards, gardens, shade trees and all manner of useful plants.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

AIRPLANES AND FEEDING OF GAME

As contrasted with the unwise use of the airplane in hunting or the distribution of poison, we are glad to note that the airplane is coming into usefulness as a means of carrying a needed supply of food to starving game birds and mammals.

Riverside County suffered a disastrous brush fire during the dry season last year which burned over thousands of acres of land. Many game birds and some mammals were destroyed. After the fire, it was observed that the quail which escaped faced another dilemma—starvation. The Riverside Chapter of the Izaak Walton League of America fostered a plan to distribute grain by airplane. The funds to carry out this project were raised by popular subscription and actual relief was administered to the birds in the stricken area.

A report from Hillsboro, Oregon, is to the effect that last winter Dr. E. H. Smith, an aviator, rigged a hose attachment to the fuselage of his plane and spread grain over an area one mile wide by two miles long. The report states that quail, pheasants and other birds flocked in and took advantage of this needed food supply.

EDUCATION ONE PRIMARY NEED

The Wisconsin Conservation Commission has inaugurated a department of education and publications. A recent bulletin from that bureau briefly recounts the progress made during the past year and calls attention to an enlargement of its scope of operation to include con-

structive and educational measures in addition to the propagation and distribution of game fishes, birds and animals.

"To justify itself," the bulletin states, "conservation must mean the creation of conditions under which forests will grow and the restoration of our marshes and wild lands to attract bird and animal life."

The Wisconsin Commission declares that forestry and reforestation must provide the background for all true conservation work. Forests provide cover and food for our game population and also act as watershed, which provides constant springs, clear streams and lakes which harbor fish and waterfowl.

The adoption of uniforms for conservation officers during the year is declared to have been a great help in securing respect of the people of the state for the conservation laws. Conservation officers carry on continuous propaganda of education instead of devoting their entire time to the apprehension of petty offenders. Notwithstanding this policy, 1513 arrests and convictions were secured during the year for violation of the fish and game laws, resulting in fines amounting to \$54,000.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

IDENTIFICATION OF DEER MEAT NOW POSSIBLE

Years ago, chemical tests were developed for distinguishing deer meat from other kinds of meat. Game wardens often confiscate dried meat which the violator maintains is goat rather than deer meat. Consequently, a satisfactory means of determining venison is desirable. Dr. H. Van Roekel, pathologist for the division, has manufactured the proper serum and is now in a position to analyze deer meat properly. In times past, court cases have been won by a demonstration of this test.

STRIPED BASS TO BE PLANTED IN SALTON SEA

The chambers of commerce in various cities in Imperial County have continually requested a survey of Salton Sea to ascertain whether fish resources might not be improved in that body of salt water. During March, George A. Coleman, biologist for the Bureau of Fish Culture, was sent to Salton Sea to make an investigation and to determine the suitability of this lake for sporting fish. An attempt was made to secure all the different kinds of fish found in that body of water at the present time, to secure invertebrate forms of life that might furnish a food supply

for fish, and to secure samples of the water for chemical analysis.

As a result of investigations, decision has been made to experiment with the introduction of striped bass. The stocking will be attempted next fall. Should the introduction of the striped bass in Salton Sea succeed, attempts will be made to stock other alkaline lakes.

SCIENTIFIC COLLECTING PERMITS

Under an amendment to the federal regulations approved April 23, 1929, holders of scientific collecting permits are restricted in the taking of migratory game birds on any day to the period from one-half hour before sunrise to sunset. It has always been understood that holders of state collecting permits would observe the ruling imposed upon all game bird hunters. The California Division of Fish and Game is glad to establish this ruling.

MEXICAN QUAIL SENT TO ITALY

The recent shipment of 2928 Mexican quail to the University of Bologna, Bologna, Italy, for restocking purposes, was the first large consignment of such birds made to a European country, according to the United States Biological Survey. The quail were brought in from Mexico at Brownsville, Texas, and were shipped through an American importer on February 28, 1929.

AUTOMOBILES A MENACE TO WILD LIFE

The increasing number of automobiles being driven over improved highways at higher average speeds are becoming a growing menace to wild life. Better servicing facilities and more liberal speed regulations are responsible for the increasing deaths of living things that chance near the highways.

According to the Automobile Club of Southern California, a member of the State Department of Agriculture recently made a count of carcasses passed while on two motor trips covering 632 miles. In all 255 bodies were counted which had been crushed by speeding automobiles. These represented 29 species, including 43 mammals, 144 birds, 40 reptiles and 28 domestic fowl.

SALMON DISCUSSED AT MEETING

The Fourth Annual Conference of the Pacific International Salmon Investigation Federation was held at Vancouver, B. C., on April 5. Mr. Henry O'Malley, United States Commissioner of Fisheries, presided.

Much attention was given to the subject of power dams and their effect on salmon

streams. Salmon packers and conservation officials stressed the menace to salmon streams as a result of hydro-electric projects. There was outspoken criticism of the alleged antipathy of power companies to the dangers involved. The same viewpoint was expressed in a paper by N. B. Scofield, in charge of the Bureau of Commercial Fisheries, whose paper was read by Prof. J. O. Snyder, Stanford University.

DEPUTIES THWART NOVEL METHODS OF VIOLATORS

The increased efficiency of the patrol department, with its large force of deputies, has brought about improved systems of law evasion by the insistent violator of the fish and game laws. He has been forced to use the best illegal methods and to scheme and plan for the purpose of devising some system which is new and different in order to avoid detection and apprehension.

In the region comprising San Francisco and San Pablo bays this very thing is being experienced. Formerly, it was the custom of deputies, among other things, to search for commercial fishermen who operate beach seines in districts 12 and 13. Very few of these nets have been confiscated in these districts for some time, due to the fact that fishermen using them have been hounded so thoroughly. It was thought for a time that the beach seine problem had been overcome. However, a recent discovery disclosed that some of the old offenders were using a drift gill net in the fashion of a beach seine. The position of a gill net is lawful in the above districts, but becomes unlawful when used within 300 feet of the shore, and is defined as a beach net when hauled from the water for the purpose of taking fish.

As a rule, set nets are placed straight across a stream. Here again the persistent violator, in order to effect his purpose, has made a severe departure from the established form. Set nets are now found in streams or sloughs up and down stream, or at angles to the stream. A great difficulty is experienced in finding nets so placed, and unless the area is traversed in a zigzag fashion with grappling hooks, the nets escape detection. These nets are usually set below the surface of the water and can be found by hooking onto them.

Deputies operating in fields and forests are experiencing the same difficulties and must always have their wits about them to be successful in detecting novel types of violation. Violators are seldom seen nowadays along the roads and highways;

they perpetrate their deeds back off the mainly traveled thoroughfares where they believe deputies will not find them.—Walter B. Sellmer.

FORCE AND PERSUASION

Force has been effective in staying the hands of the greedy and unprincipled. Those, for instance, who will not be moved by appeals for the conservation of game because of its inspirational and recreational values, must be brought into line by laws that command and threaten. However, for those who possess that obedience which yields to an enlightened understanding, fines and punishments are not altogether appropriate remedies. In an attempt to reach every type of individual and to make conservation popular with everyone, a county game warden in Washington places the following sign in a conspicuous place while on patrol when conditions do not prescribe secrecy or concealment.

"The Whitman County Game Department is making every effort to furnish plenty of good sport for every good sportsman, whether he be local or transient. We ask you to play the game square. Respect our game laws, especially bag limits, and by all means respect the rights of our landowners and leaseholders. Do not shoot near or in the direction of any live stock, nor toward any farm buildings. Don't be a game hog. Bring only good sporting blood into the field. Assist us in keeping this a good place to hunt, you may wish to come back some day."

SOCKEYE SALMON SUCCESSFULLY INTRODUCED

Efforts to stock a number of landlocked lakes in Flathead County, Montana, with sockeye salmon (*Oncorhynchus nerka*) have proved successful, according to the February number of Montana *Wild Life*. Initial plantings were made in 1916. The parent stock were landlocked sockeye salmon acclimated to a lake in Washington. These fish had adjusted themselves to fresh water conditions and were propagating. Some 200,000 eggs constituted the original shipment to Montana.

It is reported that 30,000 eggs were secured in the fall of 1928 by Montana fish cultural operators from fish in the south end of Flathead Lake. It is expected that with improved equipment and better knowledge of conditions that next year the number of eggs secured will reach a higher figure.

Experiments with the true silver salmon and Chinook salmon have proven

that the sockeye salmon is the better fish for their purpose. The former seldom, it is claimed, reach three pounds in weight in Montana waters, and so far no practical way has been discovered to secure their eggs for replanting. In a number of the Montana lakes where the sockeye salmon have been planted, they have made a good growth and have proven a real asset. They take a trolling spoon or fly and when hooked, put up a grand display, sometimes leaping out of the water three or four feet.

TULAREMIA IN SIBERIA

Tularemia, one of the new diseases which until now has been apparently limited to this country, has just appeared in Siberia. A short time ago it was recognized for the first time in Japan. Now a specimen of blood serum from a guinea pig was recently received by the Hygienic Laboratory in Washington with a request to examine it for tularemia. The examination was made and showed that the blood came from an animal infected with the disease.

The specimen had been sent from the Sanitary and Bacteriological Institute of Sverdlovsk (Ekaterinburg) in the Ural region of Asiatic Russia.

Tularemia was recognized in this country only during recent years. It made its appearance first in the west. Hunters and others who handled rabbits were suffering from a strange new illness. Dr. Alec Francis, one of the U. S. Public Health Service, discovered that the disease was caused by an organism found in rabbits or other rodents which transferred it to men by their bites. Also, merely handling the infected animals, as in the case of butchers dressing rabbits, was a source of infection.

Until the report of a case in Japan a few months ago the disease had not occurred, or at least had not been recognized, outside of the United States. Dr. Francis, who has done all the pioneer work on tularemia and is an authority on the subject, thought the disease was traveling from west to east. The New England states have not had any cases so far and it has only very recently appeared in New York state. Whether it has jumped clear over to Siberia in its eastward course or whether it has always been there, though unrecognized, is a question.

A single chance remark, dropped by Leon Trotsky in one of his articles now being printed in a number of American newspapers, has given a hint to American public health authorities of the possibility

of a widespread and severe epidemic of tularemia, or "rabbit fever," in European Russia. Speaking of the desolation of the countryside near Kursk, where the train bearing him into exile was held up for a number of days, Trotsky said, "Crows and ravens came in flocks to feast. There were no hares, because all had died of a terrible epidemic during the winter."—*Science*, March 8, 1929.

BEAVER THRIVES IN FORMER RANGE WHERE STOCKED

In the early trapping days the greater part of the Mississippi Valley was swarming with beaver. Beaver skins were almost the only important item in the trapper's catch; other furs were of little value and were only taken incidentally. The beaver, like the buffalo, were swept away by commercial greed. Having been restored to certain limited areas in northern Minnesota, Wisconsin and Michigan, they are gradually, under protection, extending their range again.

A number of beaver were liberated last fall on the upper Mississippi River Wild Life and Fish Refuge near Wabasha, Minnesota, and they have since been observed to have erected lodges and collected food for use during the past winter. The favorite food of the beaver in that region is the bark of the aspen or poplar and willow, an abundance of which is found along the bayous and sloughs bordering the Mississippi in the refuge. It is the belief of Superintendent W. T. Cox that the bottom lands being so well timbered and watered are well adapted to the restoration of beaver.—*Game and Fish Conservationist*, Richmond, Va., March-April, 1929.

PUBLIC SENTIMENT AND CONSERVATION

All of the remedies for the decreasing fish and game that have been printed would stock a library. The magazines are full of them. We speak about conservation, we urge law after law for this purpose. We want bag limits, we want game farms and fish hatcheries. But most of all we want laws.

What good will laws do us? Not one bit of good. The salvation of game and fish in this country rests squarely on the sportsman. If the sportsmen of this country do not want conservation, will not practice conservation, then all of the laws in Christendom would do not one bit of good.

We can not legislate game back, nor can we legislate more fish. But if the sportsmen really want conservation, they can have it, and they can have it even if

there is not one single law on the statute books of their states.

Conservation is a matter of public sentiment. If public sentiment is for it, it will become a fact. If public sentiment is opposed to it, all the king's horses and all the king's men can't haul it into actual existence.

Public sentiment is swinging to conservation of our outdoors. Of that there is no doubt. It means the salvation of our game birds and animals while there yet is time to save them. It means that we will do more for those that come after us than those who preceded us did for us. Which, after all, is largely the fundamental law of civilization.—*Examiner*, Bartlesville, Oklahoma.

BIG GAME COUNTED FROM AIRPLANE

The value of the airplane has again been demonstrated—this time as a means of counting and observing big-game animals. On a recent flight over the Big Delta region southeast of Fairbanks, Alaska, according to one of the game protectors of the Alaska Game Commission, an official of an Alaska airways company saw about 500 caribou and 9 moose, and three days later near the Toklat River counted 20 moose, 12 of them in pairs, 3 in one bunch, and 5 in another. The reactions of the moose and of the caribou to the airplane and its noise, says the protector, were quite opposite. The moose paid practically no attention to the strange machine, lifting their heads now and then to look at it but usually not becoming frightened. The caribou, however, became considerably alarmed and ran away. The tracks and trails of the animals were plainly visible from a considerable height. It is illegal to hunt game animals of any kind in the Territory from an airplane, and persons so doing are subject to fine or imprisonment, or both.—*The Official Record*, United States Department of Agriculture, April 11, 1929.

IT TAKES FOUR YEARS TO PRODUCE ONE POUND OF TROUT

It requires four years to produce one pound of trout. These figures have been arrived at by experts in the fish division of the Michigan Department of Conservation, who are giving their best efforts to keep the supply of fish in Michigan streams at the point where it will equal the demand. The next time you sit down to a dinner with five pounds of trout as the principal item on the menu, try to realize that it took Mother Nature many years to provide the delicacy. While the growth of fish varies greatly as to species

and natural conditions imposed by nature during their growth, it is estimated that the average fish may be legally taken after two years of growth. Water temperature and the vigor of the individual are the two principal factors that determine the growth of a fish. For instance, one trout may be treated to ideal con-

of land service in which the inspirational, spiritual, and recreational potentialities of lands under the control of the federal government and their rapidly increasing importance and value to the people of the nation would be recognized and safeguarded.

"The area involved" continues one of



FIG. 84. Exhibit of brood pond system at the Mt. Shasta Hatchery. Pleasure Boat Show, Civic Auditorium, San Francisco, April 27 to May 4, 1929.

ditions and grow so rapidly that he will be ready for the pan in eighteen months, while another may meet with reverses and not attain legal length until he is three years of age.

If you pull out an eighteen-inch bass, you may safely guess that the old boy is seven years of age. Again a blue gill that measures nine and one-half inches is probably from four to five years old. As a general thing the blue gill requires three years before he is considered eligible for the hook by the law. Experts who have handled fish and watched their growth for the Department of Conservation in Ohio maintain that fish grow one-twenty-fifth to one-fiftieth of an inch per day. There is a wide degree of variation even in these figures. Some fishermen become impatient with efforts being made to restock the streams and lakes of Michigan, but if they will pause to consider how long man must wait on nature to complete his work many of the arguments fade into thin air. —*The American Field*, March 2, 1929.

MINNESOTA RECOGNIZES A NEW LAND SERVICE

The State of Minnesota on March 8, 1929, memorialized congress to pass the Shipstead-Newton Bill. The bill, it is claimed, "if enacted into law, would give legislative sanction to a new conception

the authors of the bill, "is closely related to large centers of population. As population grows it will have increasing need for such areas as described in the bill to moderate the strain of modern existence, for the regeneration of its spiritual, mental and physical vigor.

"The testimony submitted to the committee," states Senator Shipstead, "has established the fact that the potential water power resources of the lands described in the bill are of considerable extent, but that their realization necessarily would involve considerable modification of water levels markedly destructive of the present scenic beauty and inspirational power of a large part of the region and possibly of great detriment to the fish and animal life with which the region now abounds."

Because of the importance of this act, the resolution is reproduced herewith in full.

WHEREAS, There has been introduced, and is now pending before the congress of the United States, introduced in the Senate by Senator Henrik Shipstead, as Senate Bill, S. No. 3913, and introduced in the House by Congressman Walter H. Newton, as House Bill, H. R. No. 12780, that certain bill now commonly known as the Shipstead-Newton bill, which prohibits any and all further al-

teration of the natural water level of any lake or stream within or bordering upon the area now known as the Superior National Forest, and all other public lands of the United States situated north of township 60 north in the counties of Cook, Lake, and Saint Louis, in the State of Minnesota, including the natural shore lines of Lake Superior and of the lakes and streams forming the international boundary so far as they lie within this area, which will result in flooding lands of the United States therein, without the consent of congress, and places restrictions upon logging and upon all forms of entry or appropriation under the public land laws of the United States in such area; and

WHEREAS, This region, a part of the fourteen thousand five hundred square miles covered by the Rainy Lake watershed, lying in Ontario and Minnesota, and the immediately adjacent lands and waters constitutes the only remaining vast wilderness area in the central part of North America; and

WHEREAS, This region contains the only remaining extensive coniferous forests in the Middle West with unusual potentialities for the development of a future continuous supply of forest products; and

stock, and increase various species of wild life of invaluable economic and aesthetic importance to both nations; and

WHEREAS, This region is now a great and beautiful pleasure ground for lovers of nature and wild life, visited annually by ever increasing thousands of recreationists; and

WHEREAS, The unrestricted development of this region may destroy or substantially injure the said forests, lakes and streams for recreational purposes, and may hinder the enactment of proper regulatory legislation for the development of this region consistent with the general purposes of such recreational area; now, therefore be it

Resolved, by the Senate of the State of Minnesota, the House of Representatives concurring, that the congress of the United States be memorialized that it is the sense of the members of the legislature of the state of Minnesota that such bill should be enacted into law, and such action be taken before the adjournment of congress now sitting.

Be it further resolved, That the secretary of the senate forthwith transmit a copy of this resolution to the President of the United States, to the Secretary of the Interior, to the Secretary of Agri-



FIG. 85. Exhibit of propagation of game birds, State Game Farm. Pleasure Boat Show, Civic Auditorium, San Francisco, April 27 to May 4, 1929.

WHEREAS, This region is blessed with precious historic values, rare scenic qualities and unique recreational facilities within easy reach of one hundred million residents of both Canada and the United States; and

WHEREAS, This area affords an unusual opportunity to preserve, perpetuate, re-

culture, to the United States Senate, to the House of Representatives, to the Senate Committee on Agriculture and Forestry, to the House Committee on Public Lands, and to each Senator and Representative in Congress from the State of Minnesota.—*Outdoor America*, May, 1929.

AGE AND MOVEMENTS OF ELK STUDIED

An elk killed on Big Sahara Creek a tributary of Fish Creek in the Gros Ventre Valley, Wyoming, on November 20, 1928, was found bearing an ear tag (No. 7) put on at the elk refuge at Jackson, Wyoming, on March 4, 1925, by a field investigator of the Bureau of Biological Survey. The animal had a six-point head of fair size. This is one of a considerable number of young elk that were tagged to determine their age and movements as they are encountered during succeeding years. Usually the tags are attached to the newly born fawns on the summer range. This tagging of elk is a part of a detailed study now in progress to obtain complete and reliable information regarding the habits of these animals, their numbers, movements, food supplies, and other conditions affecting them. The work is being done by the Biological Survey in cooperation with the Forest Service, the National Park Service, the State Game Department of Wyoming, and other agencies.—*The Official Record*, United States Department of Agriculture, April 11, 1929.

FEEDING OF GAME

A bulletin urging the feeding of game has been prepared largely from data and suggestions submitted by game refuge keepers and other field officers of the Pennsylvania Board of Game Commissioners, who have had considerable experience in feeding upland game. It is hoped that through its publication Pennsylvania sportsmen and all other wild-life enthusiasts will have a better understanding of practical and inexpensive methods of feeding game, particularly in winter. An ample supply of food is essential to the conservation and increase of our valuable wild-life, and the cooperation of all interested forces is necessary if this food supply is to be properly maintained.

No attempt is made in this bulletin to discuss feeding of wild waterfowl, as this subject was fairly well covered in a bulletin prepared several years ago which is now available upon application. The title of that bulletin is "Wild Waterfowl Foods and How to Grow Them."

Since feeding upland game during severe cold spells is one of the most important phases of conservation work, this bulletin treats of winter feeding fully, but the planting of trees and shrubs which produce game food should not be overlooked and this permanent phase of the game feeding program is briefly discussed.

A great variety of feeding shelters have been experimented with on game refuges and elsewhere, but in this bulletin only the more practical types are described, and most of these lend themselves to innumerable variations suitable to different conditions and depending on materials available for construction. Sketches were made by L. A. Mackey, draftsman in the Bureau of Refuges and Lands.—*More Food for Upland Game*, Bull. No. 11, Board of Game Commissioners, Pennsylvania.

EXPLOITATION BAD POLICY

It can not be too often or too strongly emphasized that the current practice of advertising and exploiting the fishing opportunities on lakes and streams of the several states by tourists and recreation resort interests is a bad mistake. There is a strong sentiment against this among many resort owners themselves and many of them are now issuing beautiful and attractive advertising without making use of the disgusting fish hog pictures which formerly decorated all such publicity. Others, not having seen the light, still persist in this kind of advertising, which is bound eventually to have a very unfavorable reaction on their business.

The fish propagation departments of every state and of the United States are exerting their utmost efforts to meet the demand for restocking and all possible protection is given by law to fish in spawning time nearly everywhere, but there is continued complaint that fishing is growing steadily poorer, notwithstanding the efforts that are made to maintain it. This being true, it would seem to be the height of folly to try to induce more people to take the choice varieties of game fish and thus hasten the depletion. Every state which maintains a tourist advertising bureau has an abundance of attractive features which can be exploited to attract visitors without telling them that the streams and lakes are overflowing with fish and that the fishing is exceptional. Such advertising is usually untrue and misleading, as well as destructive. It ought to be discouraged by every sportsmen's club in America. This sort of exploitation is nothing more or less than commercializing a resource which demands greater protection and more encouragement by propagation if it is to be maintained. *Game and Fish Conservationist*, Richmond, Va., September-October, 1928.

ECONOMIC IMPORTANCE OF THE GREAT HORNED OWL

A study of eggs of the great horned owl in Manitoba, by Ralph D. Bird, which in-

cluded many stomach and pellet examinations, led to the following conclusion:

"By this study of the great horned owl in a well settled district it was found that the bird is decidedly beneficial. Although the nests were not far from farmyards, only one domestic fowl was found to have been taken. Apparently there is no danger if the fowl have access to sheltered roosts at night. True, some game birds are taken, but these do not average as many as two per nest and we can easily spare this number in return for the amount of good that is done. The number of other birds that they destroy has no economic significance.

Probably the greatest benefit to man by this owl is the destruction of enormous numbers of moles, gophers and mice,

until the end of the season shooting was very spotted. After the season closed, the birds arrived in numbers, but it was then too late. Whatever sport the shooters missed because of the lack of birds last season they have been more than compensated for this past year. The owners of blinds from the southern end of San Francisco bay to Suisun declared that it was one of the best seasons for this type of shooting in many years.

Canvasbacks and bluebills were plentiful, and many limit shoots were made. In some places, the pond ducks, including sprig, worked into the bay shore blinds. This sport is becoming one of the most popular types of duck shooting. Because of the fact that any hunter who will work for his sport may enjoy it, it



Fig. 86. Liberation of game birds reared at Yountville Game Farm on Snyder Ranch, Sonoma Valley. Photograph by Joe Baccaglio, November 13, 1928.

whose depredations to the grain crops are only too well known. Of not such direct significance, but nevertheless of great economic importance, is the destruction of rabbits which are often very abundant, extremely injurious to young trees, and second only to fire as a factor in checking the spread of the forests."—*The Canadian Field Naturalist*, April, 1929, p. 83.

BAY SHORE HUNTERS HAVE BETTER SPORT

During the 1927 season, bay shore duck hunters had a very poor year. There were a few canvasbacks on the bay in the early season, but from the first few days

is the "poor man's" type of shooting. There is no expensive club to keep up, no keepers to pay and no baiting to be done.

QUAIL AND ORANGE TREE FUMIGATION

A letter from the orange belt, near Dinuba, reports the gassing of considerable numbers of quail as a result of fumigation. This is not the first time that reports of this sort have reached the division. It certainly is true that quail prefer thick foliage trees for roosting at nights and that they will travel considerable distances from brush areas to an orange grove in order to find good shelter.

It is also true that when careless workmen throw a tent over an orange tree, it often entraps a number of birds and that quail in some numbers are thus killed with the poisonous fumes.

There is little excuse for such destruction of wild life, for, with a little precaution and extra work in beating the trees first, birds are driven out and thus saved. In most instances, county agents and horticultural commissioners see to it that reasonable care is utilized in fumigating orange orchards in order that bird life will not be destroyed. Since enormous amounts of poison are now scattered broadcast in the state for the destruction of rodents and predatory mammals, it is becoming more and more necessary that the utmost care be utilized in protecting the innocent from destruction with the guilty.

STEELHEAD FISHING IN CALIFORNIA

As in the case with other coastal regions, California has many rivers and streams which receive one or more runs of steelhead, but the farther south one gets the less water is carried by the streams, until finally, in the southern part of the state, the rivers are completely dried up for a considerable part of the year. Besides the rivers specially mentioned below, steelhead are taken in season from the Mattole River, near Petrolia; from the Big Lagoon and creeks near Orrick; from streams in the vicinity of San Francisco, and farther down the coast. It is largely winter fishing, however, if large steelhead are sought; the season opening December 15 and closing February 28, with fishing restricted to tidewater. January steelhead of 10 pounds will be taken from the lagoon of the Ventura River by casting large spinners, and the Santa Ynez River runs it a close second. The fly fishing streams of consequence follow:

Klamath River. A justly celebrated steelhead river, practically on a par with the Rogue River and longer than the latter. Near Hornbrook and at Klamath Hot Springs, Alger and vicinity, the September fishing is claimed by many to be unequalled on the continent. From here, down to Requa at its mouth, during August, September and October, unusual fly fishing is certain, though during October, the lower reaches are likely to be made murky by mining operations above. (An effort is being made to have the mines remain closed until some time in November.) The upper Klamath remains good throughout the season. The best lower waters are between Klamath Glen and the mouth of Blue Creek

(reached by motor boat from Requa), with exceptional fishing in Blue Creek for rainbow and cutthroat trout. Royal Coachman, Brown Hackle and McGinty, sizes 4 and 6, are recommended.

Eel River. North, Middle and South forks. Ferndale, Alton, Fortuna, and Loleta regions have pools which are much sought during season—July to November, inclusive. Sizes 6 and 8 flies are generally used, mostly salmon patterns, containing red, yellow and white—Jungle Cock patterns predominating. Fishing is excellent for small trout and those up to 5 or 6 pounds.

Smith River, town Smith River. Has no summer run. Small October and November fish take a fly, same patterns as Eel River. On a spinner they run to 5 pounds. January and February see the heaviest runs and largest fish. Take a spinner best. (Winter fishing above tidewater prohibited.)

Navarro, Noyo, Mad, Ten Mile and Guala rivers all afford fly fishing in their lower waters after first rains to the close of season. Fly fishermen also take steelhead from the Russian River and riffles up the valley of the Sacramento River, using in both No. 2 spinners, copper and nickel.

Note.—Lest any confusion arise, the compiler wants to make it positive and definite that fishermen, planning on coming considerable distances for the principal purpose of fly fishing for steelhead, should consider first the Rogue and Klamath rivers. Then, but only as alternatives, the Eel and North Umpqua. The first two are so far superior to all others that no question of doubt exists.—*Outdoor life*, April, 1929.

INFORMATION FOR FUR FARMERS

Fur farming is not the "get-rich-quick" kind of business that many persons have come to believe it to be, according to the Bureau of Biological Survey of the United States Department of Agriculture. Many who inquire about fur farming have the notion that they can fence in a rugged piece of land, turn loose some fur bearers and collect large profits with little effort, but the Survey advises prospective fur farmers with little experience to obtain employment on a fur farm where they may familiarize themselves with the principles involved before engaging in the business themselves. In a new publication, Leaflet No. 27-L, "Recommendations to Beginners in Fur Farming," just issued by the department, recommendations to beginners in fur farming are outlined, and particular attention is called to the popular misconceptions regarding the enormous profits to be realized. The leaflet also

contains general information on how to make a start in the business, on areas suitable for fur farming, where to obtain breeding stock, what it takes to make a good fur farmer, and species suitable for propagation. Foxes, fishers, martens, minks, otters, skunks, raccoons, opossums, beavers, muskrats and rabbits are the kinds of fur-bearing animals treated. A copy of the leaflet may be obtained by writing to the United States Department of Agriculture, Washington, D. C.

THE WISDOM OF DOE KILLING

The controversy brought about by Pennsylvania endeavoring to reduce the number of female deer has brought out the following statement in support of the buck law, a well established custom in most states.

E. Raymond Hall, of the University of California, writing in the *Canadian Field Naturalist*, in March, states that he champions the protection of the female at the expense of the male in the case of deer and in any species of American game where polygamy exists for the obvious reason that cases of potential mating are not diminished if one-half the population of males be eliminated, whereas an elimination of one-half the female population would cause a potential decrease in mating of the same amount, namely, one-half.

FREE SHOOTING VERSUS CLUBS

In America, where the wild game is the property of all the people, the theory that the privilege of taking game should be enjoyed equally by all has become firmly established. Free shooting, however, is by no means general and fully enjoyed, because it frequently comes in conflict with the rights of landowners.

The development of shooting clubs in this country has in many places given rise to extreme resentment and prejudice. This is evidenced very strongly in the northwestern states, particularly the Dakotas and Minnesota. Laws have been passed in the Dakotas discriminating against shooting clubs and for the purpose of giving the public access to desirable shooting places.

In recent session of the Minnesota Legislature, according to the American Game Protective Association news service, this feeling was expressed in a bill intended to do away with all monopoly or special privilege in shooting by a provision prohibiting any owner of land from shooting on his own property unless he permitted the public the same privilege. Such an act would destroy private shoot-

ing clubs. It would prevent the farmer from shooting on his own ground unless he permitted others to do the same. Naturally, the bill attracted both strong support and violent opposition and did not become a law.

Such measures indicate a problem which exists and which must be solved. Some advocate abandoning the theory of free shooting in America and reversion to the European theory that the game goes with the land. It is believed, however, by advocates of the democratic idea that a system can be devised whereby the landowner can be protected from invasion of his rights and at the same time a monopoly of sport can be prevented. It is to be desired that the health-giving recreational privilege of field sports shall not be confined to the privileged few.—*The American Field*, May 11, 1929.

BROWN TROUT THRIVE IN RUSSIAN RIVER

A late and earnest endeavor has been made to furnish a non-migratory trout that would thrive in the lower reaches of the coastal streams. During the summer seasons, coast streams teem with small steelhead trout, but sizable trout have gone to sea and are not obtainable. In furtherance of the desire for the improvement of fishing conditions in these streams, black spotted trout have been planted in Humboldt County. In 1927, a fine load of brown trout which had been held in holding ponds were liberated in the Russian River. A year later, some fine large brown trout were secured. Most of them average from seven to twelve inches. Another stocking of this river with brown trout was made in 1928.

NEW DISEASE AMONG FISH

The first widespread outbreak of rickets among fish has been recognized in the so-called "knothead" carp of the middle Illinois River. According to Dr. David H. Thompson, of the Illinois Natural History Survey, rickets in human babies and in the lower animals is due to a lack of vitamins. The symptoms in the carp are a small, deformed head, which gives the disease its name, together with swollen gill coverings, defective skeletal parts, and drooping fins without the normal number of notches. The scales, skull bones and vertebrae have numerous secondary growth rings which make age determination difficult.

Carp with extreme development of knothead are somewhat softer-fleshed than normal and have a slight tendency to a "gassy" taste. Although the meat is not known to be unwholesome, such specimens

are thrown out by fishermen and do not find their way to market.

TUNA SCARCITY

It is not only "longer between bites" for the angler, but it is a "greater distance between hauls" for the commercial fishermen. Over 15,000,000 pounds of albacore were taken off the California coast in 1921. Since then the catch has dwindled year by year to less than 4,500,000 pounds. Other tuna now are more widely utilized. To maintain the pack cannery are building larger boats with a greater cruising radius. Recently the *Hermosa* went over a thousand miles to get a catch of tuna. The round trip was 2100 miles. On the coast of Salvador, Central America, this boat secured a record catch of 200 tons. These fish brought \$120 per ton. The future will see operations extended in wider and wider circles. Here is a situation that needs careful attention. Prevention of depletion is better than continually extended operations!

MIGRATORY BIRD CONSERVATION COMMISSION APPOINTED

Secretary Hyde will be chairman of the Migratory Bird Conservation Commission, as provided by the Migratory Bird Conservation Act, to pass upon the purchase of lands recommended by the Biological Survey for refuges to be established under the act. The other members of the commission will be as follows: From the president's cabinet, Secretary of Commerce Robert P. Lamont and Secretary of the Interior, Dr. Ray Lyman Wilbur; from the Senate, Senator Peter Norbeck, of South Dakota, and Senator Harry B. Hawes, of Missouri; and from the House of Representatives, Ernest R. Ackerman, of New Jersey, and Sam D. McReynolds, of Tennessee.—U. S. Bureau of Biological Survey.

ELABORATE PLANS FOR BANDING OF DUCKS

An elaborate plan for duck banding operations is being worked out by A. D. Trempe, Michigan sportsman, who stayed in California over the winter. It is the intention of Mr. Trempe to place a series of banding stations along the Pacific Coast from Mexico to Alaska. Already traps have been placed in many suitable places in the state, and when the work is finished up in the northern part of the country a more pretentious plan will be started. This plan calls for an expedition into the region where the ducks nest, including Northern Canada and Alaska, to band the birds on the breeding grounds.

This northern expedition is being planned for a future date and funds are now being obtained for the work. When this work is done a record of the actual nesting grounds of birds that winter in the United States will be nearly complete. Casual captures of birds in the north that have been banded in the state are too meager for a basis on which to base any definite theory of breeding grounds.

RETURNS ON BANDED BALD EAGLES

Two bald eagles banded in Michigan during the spring of 1928 were killed in January this year in Kentucky and Tennessee. The first bird was killed January 11 at Lexington, Kentucky, by W. Funkhouser, and the second January 31 at Reelfoot Lake, Tennessee, by G. Hite.

Although more than four hundred thousand birds in the United States and Canada now wear bands, very few of this number are eagles. Records show the first bald eagle to be banded in Michigan was the sixth ever to be banded in the United States. Three were banded in the spring of 1927 and at least eight in the spring of 1928. So far returns have come in from the above two mentioned birds only. These indicate that probably many eagles reared in Michigan spend their winter in the south. There has been considerable speculation as to whether the bald eagle of the Michigan region joins the smaller birds on the fall flight.

BUFFALO SHIPPED TO ALASKA REPORTED IN GOOD CONDITION

The introduction of buffalo into Alaska is an experiment that is being watched with much interest by wild-life conservationists. Twenty-three of these animals were shipped from the National Bison Range, Montana, to the Territory by the Alaska Game Commission in June, 1928, through an appropriation made for the purpose by the Territorial Legislature. Nineteen of them were liberated near McCarthy, Alaska, and four were held at the Reindeer Experiment Station of the United States Biological Survey at Fairbanks for experimental purposes.

In a recent report stated that up to January 9 the buffalo were located on Jarvis Creek, not far from where they were liberated, and were feeding to a large extent on wild vetch. They seem to have adapted themselves to the country and to be doing well. On February 18 the herd was reported on Clear Water Creek, nine miles from McCarthy, a stream that has open water throughout the winter and a good growth of brush and grass. The Alaska Game Commis-

sion has hay stored at McCarthy for feeding the buffalo if necessary, but up to mid-February the animals were finding sufficient food and were in good condition, although there had been some unusually heavy snowfalls.

The buffalo retained at the reindeer station are each fed at the rate of 15 pounds of hay a day, and are in excellent condition—round and fat. The winter has been unusually mild at the station, but during one brief period when the temperature ranged from 30 to 40 degrees below zero with high humidity—it was noted that the animals were covered with hoarfrost, and as soon as they finished feeding at the corrals each morning they would immediately seek an upper sheltered hollow in the middle of one of the pastures or the top of a warmer adjoining ridge. During warm weather the buffalo remain near the feed troughs at the corrals. On the range, when not grazing, they seek shelter in the forest.

MULE DEER OFFERED FOR SALE

A considerable number of surplus mule deer, or black-tailed deer, are being offered for sale alive by the United States Biological Survey from the National Bison Range in western Montana. The animals are offered at the price of \$15 each as they run on the range, the purchaser paying all expenses in connection with capturing, crating and removing the deer, which it is estimated will not exceed, on the average, \$20 an animal.

The Biological Survey does not recommend these animals for stocking ranges in the south or east, particularly in areas already frequented by deer, but say they should do quite well in most of the western portion of the United States. Where these deer are intended only for exhibition purposes they would, of course, stand a fair chance of surviving in the East.

As the Survey desires to remove the animals from the reservation at the earliest possible date, persons interested in obtaining them should communicate with Frank H. Rose, protector in charge of the National Bison Range. His post-office address is Moiese, Montana, and his telegraphic address is Dixon, Montana. Any orders accepted for delivery of the animals are contingent upon the possibility of their capture at the time desired by the purchaser.

BIRD REGULATION AMENDMENTS

Amendments to the regulations under the Migratory Bird Treaty Act, under which the game and other birds that migrate between the United States and Canada receive protection in this country,

adopted by Secretary of Agriculture Hyde on April 20, were approved by President Hoover on April 23, 1929. The nature of the amendments has been briefly summarized as follows, by the Bureau of Biological Survey, which administers the law and the regulations:

Hunting migratory game birds from automobiles is prohibited, and the closed season is continued on greater and lesser yellowlegs. In addition, certain further restrictions are made on scientific collecting, including a provision that restricts the taking of migratory game birds by scientific collectors to the period on any day from half an hour before sunrise to sunset. This change, in the opinion of the Biological Survey, will not be a handicap to legitimate collectors.

Taxidermists engaged in receiving and mounting migratory birds are now required to keep accurate records of all transactions.

PROTECTION OF SWANS NOT TO BE DIMINISHED

Explaining why no open season on swans had been provided in the recent amendments to the regulations under the Migratory Bird Treaty Act, Paul G. Redington states that he considered that to recommend an open season in the United States at this time on these beautiful and comparatively rare birds would be a violation of this country's obligations under our treaty with Great Britain. Many requests had come to the United States Biological Survey to allow limited shooting of swans, the plea being made that they were destroying wild fowl food plants by pulling them up by the roots in such quantity as to menace the future supply for other waterfowl. Answering this charge specifically, Mr. Redington said that investigations made by the Biological Survey do not show that swans destroyed wild fowl food to any greater extent than do other species of waterfowl. In fall and winter they take the parts they like, but leave sufficient seeds, fragments of rootstock, tubers, etc., to insure reproduction of the food crops the next season. "If this were not true," he stated, "swans would be compelled to abandon their favorite wintering grounds, and the fact that they do not do so, but instead return to them year after year is really a guarantee that their feeding habits are not so pernicious as is believed."

Swans have been given complete protection throughout this country, Mr. Redington explained, for two reasons. In the first place the total number of our two species combined is not large, and in the

second place, as practically all the swans of eastern North America winter in a limited area in the Middle Atlantic States, irreparable damage to the species would result if shooting were permitted. "Of the two species of swans," he said, "the trumpeter swan has been for years near the verge of extinction. Owing to the fact that it is impracticable to expect the average gunner to distinguish between the trumpeter and the whistling swans, it has seemed necessary to give all swans close protection. The Biological Survey has given the situation the most careful consideration, which it greatly deserves, since an error at this stage might very well result in the total extermination of a rare and valuable species."

DIVISION ACTIVITIES

Bureau of Patrol

During the month of February, fines were imposed amounting to \$4,500 and 138 arrests made. One violator was given a 100-day jail sentence for the possession of deer meat in closed season; two men were given 30-day sentences, one for the possession of small Pismo clams, the other for the possession of crabs; and two other men were forced to serve 25 days apiece, one for the possession of ducks in closed season, and the other for having deer meat.

The total amount collected in fines made a slight drop to \$3,665 during the month of March and total arrests were 133. One violator was given a 50-day jail sentence for the possession of a bird net and another 100 days for using an illegal net.

A total of 125 arrests was made during April and \$4,755 collected. Long jail sentences are conspicuous for this month. One violator was given a 500-day sentence.

California can boast of having about one-fourth of the deer in the national forests of the west. Efforts to perpetuate her splendid supply will become less and less effective, if violations go unchecked. Sportsmen who believe in game laws and who obey them will be glad to know that deputies are vigorously enforcing the rules imposed by the legislature that regulate the killing of deer. A total of 22 convictions was secured for the possession of deer meat during the months of February, March and April. Some record prices were paid by violators for possessing this meat. Many patients in county hospitals were enabled to vary their regular diet and had an opportunity to enjoy choice cuts of venison.

Clifford Almy, city superintendent of streets, of a fashionable Alameda County suburb, concealed deer meat in his office in the basement of the city hall. The meat was seized over five months after the season closed.

Rumors reached the San Francisco office that the Piedmont Fire Department had a supply of deer meat on hand and were planning a banquet. Considerable time and very careful following of clues was required in working up the case.

Finally, when they were sure of themselves, Assistant Chief Milton Clark and Deputy Alan Curry walked into the city official's office and asked, "Where are those two deer?" Almy maintained an expression of complete innocence and declared that there was some mistake. Upon suggestion that a search be conducted, his attitude changed and he assumed defensive tactics. Deputy Curry, at Clark's order, ascended a ladder leading to a small room over Almy's desk, and shortly brought down three hams and three shoulders of venison in fine condition. The city dignitary was taken into the court of Judge Jacob Harder, Jr., at Hayward, and upon his plea of guilty was fined \$150.

Patients of the San Francisco Relief Home were served the venison. Indeed, few patients at the Home ever have a chance to hunt deer, while a fireman can always enjoy the sport when the season is open.

Shooting a 50-pound buck in May and having the same in his possession, cost William Singleton of San Jose also \$150. Deputy I. L. Koppel apprehended him at the Harney Ranch near Mt. Hamilton and conducted the violator to the court of Judge Chester Moore at San Jose.

Patients at the Eureka County Hospital feasted on forbidden deer meat because F. H. Farnsworth of Weott was apprehended by Deputy William Kaliher at Rainbow Ridge. The carcass of the deer was still warm when the offender was caught. Farnsworth paid \$100 in the court of Judge George W. Yuill of Scotia.

At Low Gap, west of Ukiah in Mendocino County, Deputy Earl Macklin found a buck and a fawn in the possession of Harold Cook, George Hinkley and John Kinney, all of Fort Bragg. The trio were informed that it was somewhat unsportsmanlike, as well as contrary to law, to have deer meat in possession during March. They were booked to appear before Judge George Golden at Fort Bragg and were fined \$75 apiece.

Near Eureka, at a place called Rainbow Ridge, deputies William Kaliher of Loleta and R. J. Yates of Eureka, ar-

rested C. C. Estes with two hams of deer meat. The hams weighed 25 pounds and Estes was fined \$100 when he appeared before Judge Frank E. Niskey at Eureka.

A fabulous price for deer meat, and spoiled meat at that, was paid in Sebastopol early in May by Frank Sorento of the Occidental district. Fifteen pounds of venison were found in his cellar by Deputy Victor Von Arx and Captain of Patrol Henry Lencioni. Judge H. McCormack at Sebastopol established a fancy price for the meat when he fined Sorento \$250.

Deputies everywhere focused their attention on the apprehension of those who were unable to resist the lure of whipping trout streams until the season opened. Records show 34 arrests for having trout in possession and 17 arrests for angling without a license during the two months preceding the opening of the trout season. After May 1, they continued watching anglers and brought to justice many who were overgreedy.

Two fishermen had 99 trout when accosted by Deputy Fred H. Post on Church Creek, Monterey County. Taken into the court of Judge Ray Baugh at Monterey, they paid a fine of \$50 each. One offender had 46 fish, which is 21 over the limit, the other, his brother, Roy Likins, had 53, which is just 28 too many.

C. C. Harshner of Oakland fished on April 28 on Mark West Creek, Sonoma County. It was two days ahead of the official opening. However, Captain Henry Lencioni and Deputy Victor Von Arx trailed him carefully for seven hours, saw him catch fish, and hide them with his tackle. He had forty trout, beauties, too, and when he appeared before Judge Frank A. S. Oppen at Windsor he admitted his guilt and was fined \$100. Costly trout, those.

Deputy L. E. Mercer and Volunteer Deputy J. J. Elliott arrested H. S. Clark of Reno, Nevada, on Sierra Creek in Sierra County. He had 39 trout, just 14 more than the law allows. Judge Loren L. Palmerton at Loyalton imposed the regular \$25 fine for an overlimit and \$1 apiece for the 14 extra fish.

Judge R. H. Shannon of Georgetown fined Alvin Waddle of Auburn \$25 for

fishing without a license, after Captain L. T. Ward of Sacramento found 17 fish in a basket belonging to Norman Andregg, a 16-year-old boy.

Deputy W. C. Blewett arrested C. B. Naylor of Los Angeles on Santa Rosa Creek, San Luis Obispo County, when he failed to show his license on demand. Judge A. S. Gay of Cambria fined him \$25.

Deputy Forest McDermott of Santa Cruz caught Gus Mallett of Zayante in the act of attempting to spear trout in Zayante Creek. Mallett acknowledged his guilt before Judge Donald Younger, who fined him \$50.

On a plea of guilty, J. Newell Chase of Brookdale arrested by Deputy Forest McDermott for fishing before the season opened, was fined \$75. He was fishing without a license and had six trout when arrested. Judge Donald Younger levied the penalty.

In March, Joe Renna was apprehended near Mendota by Deputies Ray Ellis and H. E. Black, assisted by Ted Holliday, for shooting ducks out of season and having two ducks in his possession. Since Renna had a bad reputation for disregard of the fish and game laws, Judge Meyer of Firebaugh, Fresno County, imposed a severe fine. The violator, however, was unable to pay the \$300 assessed and was committed to jail for 150 days.

The use of traps in taking valley quail constitutes a serious threat to the preservation of this valuable game bird. W. Lee Weeding of Los Angeles is now aware of the serious nature of this offense. He was apprehended by Deputy Charles Towers and Captain LeRue Chappell of the Los Angeles force. Hailed before Judge H. E. Billings at Sherman, Weeding pleaded guilty to the charge of taking the birds in the hills back of his home, and was fined \$250. The justice suspended \$200 of the fine, however, and collected but \$50. Since only ten birds were trapped this fine amounted to a charge of \$5 for each bird. As the officers liberated the quail, they remarked that Weeding had paid dearly for the privilege of confining them for a short time.

Fred E. Bennett of Long Beach said he was guilty after Deputy Charles Towers

of Los Angeles arrested him for buying, selling and trading valley quail. Judge H. E. Billings of Sherman placed his fine at \$50.

The lone dove that Ernest Johnson of Turlock shot on May 19 cost him a goodly sum. Arrested by Deputy G. W. Magladry for shooting doves in closed season, he admitted his guilt. Judge Dan Kilroy of Turlock assessed a fine of \$50.

Undersized abalones in possession often prove to be the undoing of a number of those who seek this delectable table delicacy. Four violators were arrested by Deputy R. C. Marshall on the famed Seventeen-Mile Drive, near Monterey, and nine by Deputies M. F. Joy and McPherson Lough at Pigeon Point. One of these, K. Umino of Pescadero, paid a fine of \$100 to Judge A. W. Woodhams of Pescadero. The other eight were fined \$25 each.

Deputy Fred Post of Salinas turned in \$571 on April 16 as the fruits of his activities during the week end. Deputy Post caught H. Sugimoto, a native of Japan, near Salinas, with ten valley quail. The Japanese pleaded guilty in the court of Judge D. W. Rohrback of Pajaro and paid a fine of \$400. The quail were taken to the county hospital at Salinas.

W. S. Hubbard of Moss Landing was next. He had an overlimit of Pismo clams and on his plea of guilty, Judge Rohrback said \$100 or 50 days. Hubbard spent two days in the Salinas County jail and then decided to pay the balance due of \$96.

C. Schornick of Newman at Moss Landing was found with Pismo clams not in their shell. He was fined \$25 by Judge Harry J. King of Salinas.

Four abalone seekers, T. Tagani, Frank Yonekaura, A. Shibayama and John W. Sprague, were not careful regarding the size of those which they pried off the rocks along the coast in Los Angeles County. All paid fines of \$25 each to Judge H. E. Billings at Sherman when brought into court by Deputy R. J. Sadler.

Taking Pismo clams during the closed season at Palm Beach cost H. G. Redman \$50. Judge Donald Younger at Santa Cruz first fined the defendant \$100, but suspended \$50 of the assess-

ment. Deputy J. P. Vissiere arrested Redman.

Frank G. Pulis of Tracy caught 414 catfish in a fyke net in the San Joaquin River, near El Soyo ranch. He was overhauled by Deputies George Magladry of Modesto, C. L. Gourley of Gustine and Captain J. E. Newsome of Newman. He went into the court of Judge Hawkins at Modesto and paid \$150. Stanislaus County Hospital patients ate the catfish.

Found in possession of a fish spear, Adam Metzler was arrested on the San Joaquin River by Deputy H. E. Black and paid a fine of \$25 when taken before Judge Myer of Firebaugh, Fresno County.

During the month of April the launch patrol seized more than 16,000 feet of illegal net.

For some time Captain Walter Sellmer and his men had been seeking to apprehend a gang operating beach seines in the restricted territory of Richardson Bay. After an all night vigil, they succeeded in surprising the fishermen in a cove near Burnett's Island just as dawn was breaking. While Deputies Charles Bouton, Harry Christiansen and George Smalley patrolled the water adjacent to the place of arrest, Captain Sellmer and Deputy Lee Straight came in from another direction in a skiff and the posse closed in on the violators. The fishermen had a large quantity of fish, including 75 pounds of striped bass. Gus Marvis, an old offender, was given 500 days by Judge H. De La Montanya of San Rafael. George Nichols was sentenced 200 days, and E. B. Yows, considered the least mischievous of the three offenders, was given a sentence of six months. This was suspended for two years, but becomes effective if Yows violates any of the fish and game laws.

It may be that over in sunny Nippon the taking of fish from streams on dip nets attached to long poles is regarded as the real sporting thing to do. In Sonoma County, the act is unworthy of a disciple of Izaak Walton. So much so that it cost T. Nagihara, S. Fugihara, S. Ikeyami, R. Yokoyama and Y. Yokoyama, all of Forestville, a \$100 each for a days outing. The money was paid to Judge H. McCormick at Sebastopol after Deputy Victor VonArx took them into custody at Hilton on the Russian River. Each man had about twenty pounds of fish.

Catching twenty-five striped bass in a noncommercial district on the Mokelumne River cost C. Torabehino or Isleton an even 100 days in jail due to the vigilance of Deputy William Hoppe. Judge W. E. Everson, at Elk Grove, gave the violator the alternative of serving 100 days in jail or paying a \$100 fine.

M. J. Duarte, of Sacramento, paid \$250 for fishing with illegal nets, having undersized striped bass in his possession and fishing without a license in the Sacramento River. Deputy Charles Sibeck arrested Duarte and Judge W. E. Everson, of Elk Grove, assessed the fine. The undersized bass seized were given to charity.

One black bass taken in closed season cost S. Nakijian of Selma, Fresno County, \$40 as a result of his arrest by W. L. Hixon, a volunteer deputy of the Division. Nakijian was taken before Judge R. A. Watrous, at Dinuba.

Romy Yap, of Rio Vista, was arrested by Deputy William Hoppe for having 20 striped bass in his possession. Judge F. J. Kalber fined the offender \$50.

Stephen Hall, of Hopland, will pay \$100 on the deferred payment plan for using a gill net to take game fish. Deputy Earl Macklin found Hall at the mouth of Phalis Creek on the Russian River operating the illegal net.

"Taking of game fish in this way is mighty poor sportsmanship," said Judge J. Hoffman, of Ukiah when he levied the fine.

John Luddington, of Weitchpec, Humboldt County, was arrested by Deputy Ray Diamond at Martins Ferry for trapping without a license. He was taken before Judge Thomas J. Nix at Weitchpec and given an alternative of paying \$100 or serving 100 days in the county jail.

The General Petroleum Company operating in the Rincón Oil Fields, near Ventura, were fined \$200 for polluting the waters adjacent to their operations. Deputy R. E. Bedwell brought the offenders before Judge Edward Henderson.

Deputies working in Tulare and Kern counties made an excellent showing the past few months. Twenty-six arrests

and convictions were obtained between November and March, and a total of \$1,025 was collected. One violator was sentenced to 100 days in jail for killing a doe. Possession of deer meat in closed season in another case and over limits of ducks brought fines of \$100. Eight arrests were made for over limits of quail and ten for hunting without a license.

In addition to this fine record, the deputies in Captain O. P. Brownlow's district have also been active in fish planting and fish rescue. They have reported on the location of areas where game birds may be liberated and conducted investigations of game conditions.

Deputy C. J. Towers arrested a violator for killing game out of season in Riverside County. Unable to find the nearest judge, he started for Murrietta and on the way passed the ranch of a judge he knew. He found the justice plowing and court was held by the roadside, the judge never even leaving his plow. After taking an extra chew of tobacco, the deputy reports, the judge accepted the plea, fined the culprit the limit and sent him on his way. He then called to his horses and resumed his plowing.

Fishermen reported good fishing at the opening of the trout season in the basin of the San Gabriel River. This improved condition was due to the splendid efforts of deputies under Assistant Patrol Chief Charles S. Bauder. Some 200,000 fingerling trout, measuring over six inches in length, and almost ready for the frying-pan, were planted by the southern patrol force early in the spring. The fingerlings were raised in the new Goldbrook Camp Hatchery, and the plant involved many obstacles in an almost inaccessible country.

This spring Deputy Walter I. Long of Westwood rescued many fish ranging from one to six pounds in weight from holes in the stream bed running into Duck Lake, Lassen County. The waters of Duck Lake served as a municipal supply for the town of Westwood and a new channel cut last summer has left the old stream-bed dry.

The summary report of Captain H. W. Ehreiser of Humboldt County shows that between February 1, 1928, and February

1, 1929, the volunteer deputies of that county patrolled 30,738 miles of field and streams; that they checked 3433 hunting, angling and deer tag licenses; that in coordination with the regular patrol they made and assisted in making 29 arrests and collected \$625 in fines.

Bureau of Fish Culture

Shipments of 1,220,000 rainbow trout eggs were made from the Mount Shasta Hatchery during the month of April to six hatcheries located in various parts of the state. The Mt. Shasta subsidiary egg-collecting stations supplied over 1,795,000 rainbow eggs during this month. Five hundred seven thousand steelhead trout eggs were received from the big Creek Hatchery. These are reported to have been in good condition. On May 1 the fry and eggs on hand consisted of 3,288,000 Loch Leven, 2,192,000 brown, 14,000 eastern brook and 304,000 rainbow trout. There were also on hand 70,000 steelhead and 898,000 Quinuat salmon.

Fish cultural work at the Mt. Shasta Hatchery has involved the spawning of the trout from pond fish, the shipping of eyed eggs, the picking out of dead eggs in hatchery troughs, cleaning troughs and the general care of the fry and the preparation of fish food. The outside crew did a great deal of sorting of fish maintained in brood ponds. Many ponds were cleaned and new pond screens installed.

In general, the take of eggs in the Klamath stations, subsidiary to Mt. Shasta, has been disappointing. The water has remained very cold. There has not been sufficient precipitation to raise the creek and cause the trout to leave the Klamath River and run up tributary streams in normal numbers.

During March, a total of 853,000 rainbow trout eggs were collected at the Camp Creek station, making a total for the season of 1,049,000 eggs.

The total number of eggs taken at the Cornbrook Station was 1,440,000. At first, it appeared as though this station could do better than it has in the past few years. The lack of rain, however, reduced the farmers to start irrigating earlier and the water in the creek was lowered unfortunately just at the time when the trout were running their best. The creek became so low that the fish were unable to reach the trap and the station was closed on April 30; the racks

were removed and piled for use the next season.

May found the trout run still going on in Beaver Creek Station and operations will continue just so long as the trout continue to reach the trap. Up to the end of April, a total of 1,011,000 eggs were taken.

The amount of eggs obtained from the Shackleford Creek Station was disappointing, in view of the fact, that the first part of the run held promise of a very excellent yield. During March, 467,000 eggs were taken, and during April but 440,000. The total take for the season was 982,000. As a rule, the greatest difficulty encountered at this station is high water. This year, the opposite was true.

In order to carry out an experiment to prove whether the Atlantic salmon will thrive on this coast, a shipment of 28,000 eggs was secured from New Brunswick. The Atlantic salmon is essentially a cold water fish. A very serious effort will be made, nevertheless, to determine whether this species can be propagated in the state to advantage. It has been claimed by some that if the fish succeeds in acclimatizing itself to California waters it will prove more of a sporting fish than the native steelhead.

Another shipment of 25,000 Atlantic salmon has been received from the Bureau of Fisheries, East Orland, Maine. These will be taken care of at Cold Creek Hatchery, Mendocino County. The New Brunswick shipment is being cared for at the Prairie Creek Hatchery.

The 1,807,000 rainbow trout eggs received from Pocatello, Idaho, have been shipped to various hatcheries. The first lot of these Idaho eggs produced fish that were weaklings and losses were considerable. The Idaho people have replaced those fish lost in transit as a result of poor packing.

Eastern brook trout eggs received from the American Fish Culture Company, Carolina, Rhode Island, are reported to have developed into healthy and active fry.

At the Mt. Whitney Hatchery, Inyo County, some 350,000 Loch Leven and 525,000 eastern brook trout eggs and fry were in the course of development by the end of April.

The Rush Creek Spawning Station considerably augmented the number of eggs being cared for at the hatchery by shipments of 1,065,000 black-spotted trout eggs during April. Indications are that

Rush Creek will yield probably 4,000,000 eggs.

Fern Creek Hatchery has on hand 560,000 black-spotted trout eggs supplied by the Rush Creek Station. This hatchery also received 45,000 rainbow trout eggs from the station on the Walker River.

At the Fort Sewart Hatchery, Humboldt County, there were 1,496,870 steelhead trout being developed. These came originally from the Cold Creek Hatchery. There were also 132,680 steelhead trout from the Prairie Creek Station and 79,390 rainbow trout from Pocatello, Idaho.

Silver salmon to the number of 825,170 were planted near the hatchery in April and constituted the remainder of the fish received from the Prairie Creek Station earlier in the year. These fish were of good size and had every appearance of being strong and vigorous.

The latter part of the usual steelhead spawning season at the Prairie Creek Station passed with practically no movement of fish to the racks. The few light showers and the absence of storms failed to cause sufficient rise of water in Prairie Creek to bring about a good run. Only 98,500 steelhead trout eggs have been taken. These have been procured from occasional fish that have managed to reach the racks.

Burney Creek, Shasta County, had 301,245 eastern brook, 196,160 Loch Leven and 313,660 rainbow trout on hand the beginning of May. Over 15,000 rainbow trout eggs were taken at Ballard's Reservoir in April. This reservoir indeed holds forth the prospect of proving a splendid station for the collecting of rainbow trout eggs when properly stocked and negotiations are under way to effect these ends.

At the Big Creek Hatchery, Santa Cruz County, all the 1,592,000 steelhead eggs and fry are reported to be in fine condition. Water in the creek was as low in April as it usually is in August and there was less water in it than any other April during the past twenty-two years. From the egg collecting station at this place, 2,575,000 steelhead eggs were shipped to other hatcheries.

Steelhead in the Brookdale Hatchery, Santa Cruz County, have started feeding and are doing well. Besides these 150,000 steelhead, there were at this hatchery 248,000 silver salmon.

The latter part of April found the fish in Bear Lake, San Bernardino County, entering the streams to spawn and indications are that the Bear Lake Hatchery and its subsidiary stations will be supplied to capacity with eggs.

At the Feather River Hatchery, Clio, Plumas County, there were on hand 180,000 eastern brook, 248,000 Loch Leven, 262,000 rainbow and 295,000 steelhead.

At the Yosemite Hatchery, Mariposa County, the 48,130 brown trout fingerlings in the holding tanks are reported to be making a sturdy growth. 500,000 steelhead eggs were received from the Big Creek Hatchery and 150,000 rainbow trout eggs from Mt. Shasta Hatchery. These shipments, together with those on hand, make a total of 698,130 eggs and fry now being developed for stocking the streams and lakes in Yosemite National Park and adjacent territory.

At the Tahoe Hatchery, Placer County, the 600,000 eastern brook, 100,000 Loch Leven and 200,000 steelhead are reported to be hatching in goodly proportion and the resulting alevins are strong. The 150,000 rainbow trout eggs from Pocatello, Idaho, are clearing up.

There is a good flow of water in the upper Truckee and the fish are moving in good numbers. The yield from the Taylor Creek trap and the Blackwood traps has so far been satisfactory.

At the Tallac Hatchery, in Eldorado County, the steelhead alevins are doing well and the rainbow trout eggs are hatching.

In April, 61,500 eastern brook trout that had attained a size from two to four inches were planted in the waters adjacent to the Mormon Creek Hatchery, Tuolumne County. Weather conditions are of the best and the water is holding up well. In fact, the fish are doing so well that there is a danger of their becoming overcrowded and another plant will be necessary shortly.

At the Cold Creek Hatchery, Mendocino County, May 1 found 775,000 steelhead, 184,000 Loch Leven, 287,000 brown trout in the course of development. The 24,000 Atlantic salmon will be placed in two large tanks near this hatchery as soon as they become overcrowded in the troughs in which they are now developing.

Snow Mountain Station closed on April

2 with a total take of steelhead eggs amounting to 2,875,000.

There were on hand at the end of April at the Kaweah Hatchery, Tulare County, 188,000 eastern brook, 95,000 Loch Leven and 437,000 steelhead trout. The rainbow fry from the 116,000 eggs obtained from Idaho have hatched and the fry started feeding on April 29.

A large sign has been donated by the Visalia Sportsmen's Club and has been erected at the approach of the hatchery near the state highway. The sign reads, "Kaweah Fish Hatchery. Visitors Welcome."

Due to low water, but 21,500 rainbow trout eggs have been taken so far at the Clear Creek Hatchery, Lassen County. A total of 170,000 rainbow eggs were obtained at the Mud Creek Station and placed in the Clear Creek Hatchery.

The Warner Creek Station has so far supplied 615,000 rainbow trout eggs to the Domingo Springs Hatchery.

Butt Creek Station was open during April, but it was not possible to commence operations until the end of this month.

At the Kings River Hatchery, Fresno County, some 600,000 eastern brook, 400,000 Loch Leven, 77,000 rainbow and 250,000 steelhead trout are being cared for.

There were on hand at the Yuba River Hatchery, Sierra County, the first of May over 196,000 Loch Leven, 72,000 eastern brook and 298,000 steelhead trout.

The entire series of trout food experiments are now well under way. Steelhead trout at the Brookdale Hatchery are being fed various varieties of food, such as shrimp meal, dehydrated salmon eggs, sardine meal and alfalfa meal. Percentages of waste in each of these food materials have been worked out with Loch Leven trout at the Mount Shasta Hatchery. The experiment has not been carried to sufficient lengths yet to make any report on the results from feeding these foods.

Two trips were made by George A. Coleman up the Napa River for the purpose of determining if certain reclamations of land would interfere with the breeding of striped bass. It was decided that dredging operations in the main channel of the river above Cutting's Landing constituted no very great inter-

ference with reproduction of this fish. Observations made show that striped bass from ten inches and up are very plentiful in the river.

Particular emphasis is being placed on investigations of the food supply of striped bass. While it is known that adults will eat almost any variety of small fish, they seem to be more plentiful where certain varieties of minnows flourish. It is hoped to obtain, in the very near future, sufficient information to determine whether striped bass prefer these minnows above other types of food.

Elkhorn Slough, above Moss Landing, in Monterey County, has been the subject of considerable study to determine conditions affecting striped bass existing in a strictly salt water area. Elkhorn Slough has no fresh water supply and is directly connected with Monterey Bay. Striped bass are found there in abundance.

All forms of plant, algae, plankton, crustacea and insect life tending to produce food for these fish are being studied.

Bureau of Commercial Fisheries

On February 8, Captain Walter Enkelke and Erol Greenleaf, commercial fisheries deputies aboard the *Albacore*, arrested Messrs. Takahashi, Frank Sorgan, A. B. Smith and Anton Bosavich, all of San Pedro, for operating in a closed district at Catalina Island. The four men were brought before Judge Ernest Windle of Avalon. Takahashi admitted his guilt and was fined \$100; while the other three posted \$100 bail each which they later forfeited.

On February 12, the commercial fisheries patrol found Jim Larsen of Santa Barbara with oversized lobsters in his fishing boat. Judge Pool, of Santa Barbara, assessed a \$25 fine.

Charles Gunderson, of Santa Barbara, was caught with abalones out of season. He paid a fine of \$25 when taken before Judge Pool. C. Larsen, of Balboa Island, was also apprehended for possession of abalones and was fined \$25 by the Santa Barbara justice.

The International Pacific Salmon Investigation Federation met in Vancouver, British Columbia, April 3 to 6. Owing to press of legislative business, N. B. Scofield was unable to attend. The Division was represented by Dr. J. O. Snyder. This federation is composed of officials of the fisheries departments of the United States, Canada, Washington, Oregon,

California, Alaska and British Columbia. Its object is to perpetuate and build up the Pacific salmon fisheries to the end that their productiveness may be maintained, and, if possible, increased.

During April, J. B. Phillips was put in charge of the work of collecting evidence at the intake of the Glenn-Colusa irrigation canal near Chico. The object of the investigation is to determine whether fish go through the battery of pumps which take the water from the river. It has already been found that young salmon are going through in fairly large numbers.

The Division and Stanford University are jointly engaged in a hydrobiological survey of Monterey Bay. The patrol boat *Albacore* was stationed at Monterey during April and was used for the survey. Several offshore trips were made in attempts to take the eggs or larvae of sardines. Although a great deal of valuable information was acquired on different fishery subjects, the efforts of the investigators, E. C. Scofield and M. Lindner, failed to obtain any data on the sardines. The *Albacore* left Monterey for Eureka at the end of the month. Lindner made the trip up the coast and made tows at different places along the entire coast in an endeavor to obtain evidence of sardine spawning.

A boat has been chartered as the necessity arises to patrol the markets and fish landing places in southern California and crush the traffic in undersized barracuda and halibut. The islands and coasts were watched to prevent the catching and landing of illegal sized lobsters.

In response to the need for research in California's commercial fishes, the State Fisheries Laboratory, Terminal Island, is giving attention to sardines, albacore, barracuda and striped bass. Some work is being done with other species of minor commercial importance. Concentration on certain species is necessary to avoid dissipation and superficial treatment. Permanent and valuable results can come only after careful and painstaking investigations and require much that is exacting. Yet, such work, in the end, justifies the effort put forth and the time consumed.

Histological work in developing sardine eggs has been carried on by C. B. Andrews. This information has been needed

to supplement the studies by means of egg measurements of sardine spawning being conducted by Dr. Frances N. Clark.

Studies are being made of the ear bones of the sardine to arrive at an understanding of the rate of growth. H. C. Godsil's work on the subject is showing encouraging results.

Bureau of Education and Research

In keeping with the policy to avoid requests for lectures at distant points and much duplication of travel, educational work was centered in a number of important areas. Dr. H. C. Bryant gave a lecture in February to the Franklin High School, Los Angeles. This was so successful that requests from five other high schools in Los Angeles followed. It was possible by concentrating efforts to reach in a limited amount of time over 6000 students and to impress them with the values of fish and game resources and the need of their preservation. A number of important illustrated lectures were given before annual meetings of fish and game protective associations, the Division in almost every case being given the feature part of the program.

Through the good efforts of Captain O. P. Brownlow, Rodney S. Ellsworth was enabled to carry out an intensive schedule covering the schools and service clubs of Tulare County. Lectures were also given during this trip before schools and business organizations in Fresno and Madera counties. L. W. Cooper, county clerk of Madera County, sponsored and arranged the program in that county. He arranged for a very worthwhile meeting before the Alpha Center Farm Bureau.

For some time the bureau has entertained a desire to reach all of the principal centers in San Joaquin County. Engagements for both lecturers of the bureau in the county made possible the carrying out of this plan.

A summary of lectures given for the past fiscal year is as follows:

Organization	No. of lectures	Attendance
High schools.....	59	37,115
Grammar schools.....	36	13,940
Universities and colleges...	7	595
Civic and public service clubs.....	27	1,562
Civic and Public.....	27	2,850
Masonic and other lodges...	21	2,410
Fish and game protective associations.....	19	2,134

Boy Scouts, Camp Fire		
Girls -----	5	587
Radio -----	4	
Miscellaneous -----	26	3,218
	231	64,411

Plans for the summer educational work were inaugurated. Dr. H. C. Bryant spent the last two weeks of May in Yosemite National Park where the ranger force was given a course of instruction which placed emphasis on conservation of fish and game and natural resources.

Official photographer E. S. Cheney secured some motion pictures of steelhead

ably the only pictures of their kind that have ever been taken of this very interesting bird.

A meeting of horticultural commissioners was held at Merced on March 26. Considerable discussion centered on damage done to agriculture by birds. Discussion showed that little real or concrete evidence could be advanced to substantiate claims of reported damage. A splendid spirit of cooperation between the different state and federal departments was displayed at this meeting.

Field naturalist Donald McLean made



FIG. 87. Little brown cranes wintering in the San Joaquin Valley.
Photograph by E. S. Cheney, May 24, 1929.

fish ascending the fish ladder at Carmel River dam, Monterey County, and later, of trout ascending a ladder on the South Eel River, Mendocino County.

He obtained some excellent and unique pictures of little brown and sandhill cranes wintering in western Fresno and Merced counties. Some lively scenes of the courting antics of the birds were taken. The material was sufficient to make a complete reel and has been received with much interest and commendation.

Motion pictures of the mountain plover, a bird which migrates east and west rather than north and south, were obtained during March. These are prob-

ably the only pictures of their kind that have ever been taken of this very interesting bird. Investigations of reported damage to ranches by the Roosevelt elk in Humboldt County. Findings indicated that further investigation would be necessary at a time when the animals were actually destroying property. They had moved from the fields back into the timber. No actual attempts have so far been made by farmers properly to fence against these largest of California land mammals.

A census of breeding ducks was taken on the area bounded by Newman, Dos Palos, Los Banos and San Joaquin River.

Dr. H. Van Roekel kept a constant watch on operations at Swanton, Santa

Cruz County, in order to forestall any recurrence of the dangerous disease furunculosis. Laboratory work during March was largely occupied by examination of fish eggs sent in for this purpose.

A disease epidemic among the eastern brook trout at one of the hatcheries was investigated. Laboratory examinations of fish from this hatchery revealed no pathogenic bacteria or parasites. The trouble seemed to arise from an excess of vegetable matter in the water which was identified as floating duck weed.

Investigations on duck disease have been continued. Samples of soil collected near Buena Vista Lake and the Hollywood Gun Club were analyzed with the view to gain from these analyses, conditions of soil and water, both in places, where the duck disease is likely to appear, and in places, where it has never been known to occur.

Alkali feeding experiments have resulted in production of toxic symptoms. Several deaths have occurred as a result of these feeding experiments and work is in progress specifically to determine what particular component of alkali is the most toxic. This work has been carried on largely by Paul A. Shaw.

The quail disease investigation is in progress. Dr. E. C. O'Roke had little difficulty in reproducing the disease in healthy birds by feeding intestinal contents of dead and infected birds. Three types of organisms have now been isolated, two of which are very difficult to grow in artificial media. However, attempts to reproduce the disease with the isolated organisms have as yet been unsuccessful.

The executives of the First Annual Pacific Coast Pleasure Boat Show held at the San Francisco Civic Auditorium, April 27 to May 4 made possible the installation of a splendid exhibit. This was a simplification of the Division's exhibit maintained last summer in cooperation with the Forest Service, at the Pacific Southwest Exposition, Long Beach. Painted backgrounds were utilized to set off foregrounds depicting the cycle in fish culture and game bird propagation. The central set depicted, in a realistic manner, the harm forest fires do to fish and game. Paul J. Fair, of the Forest Service, cooperated with the Division in installing the exhibit. Acknowledgements are also due to the Steinhart Aquarium

for supplying a number of large calico bass and black bass. These fishes materially enlivened the foreground of the fish cultural display, together with many smaller ones supplied through the courtesy of the Bureau of Fish Culture and Reclamation.

Bureau of Hydraulics

An event of the highest importance and general interest occurred during the month of March. The occurrence marks one of the real achievements in the control and prevention of pollution. Two plants, representing an expenditure of over \$700,000 and an annual operating cost of at least \$50,000 were formally opened on March 20. One is located at Santa Fe Springs and will be operated by the Santa Fe Waste Water Disposal Company; the other, at Fullerton, will be operated by the Water Disposal Company, of Orange County. Over 200 state, county, city and oil company executives attended the formal opening.

At Santa Fe Springs an ingenious system of baffles and an aerator breaks up the sludge material. The water, containing the broken particles of oil, runs through tanks and over baffles made of concrete and is finally filtered through excelsior. Numerous laboratory tests show that when the oil enters the system, it contains 466 parts of oil to a million parts of water, and when it leaves averages 16 parts of oil to a million of water. In fact, the water as it leaves the system and enters into the sea is remarkably clear and free from deleterious matter.

The Orange County system consists of a settling tank arrangement. The tanks are built of concrete and by a unique use of wind and water flow, the oil is diverted so that it may be skimmed off in a narrow channel. This carries it into a settling basin for final treatment. Tests show that the percentage of oil removed by this system is as good as that of the Santa Fe Springs. The two systems are capable of handling about 100,000 barrels daily.

These systems conclusively demonstrate what can be done to eliminate oil pollution and serve as a splendid example of the highest type of effort to correct serious menaces to fish and plant life. They are an illuminating instance of the ready willingness of the oil industry in general, to cooperate with the division. Although their operation will amount to a large sum yearly, nevertheless, it is hardly possible to estimate the real benefits which will result.

The complaint against two of the four concerns originally named for oil pollution at Summerland, Santa Barbara County, was dismissed in April. The Seaside Company and J. E. Lillis have so improved their properties as to make this act possible. Assurance has also been given by these operators that they will continue to cooperate and maintain their premises in a satisfactory condition.

The other two companies, the Submarine Oil Company and G. F. Becker, were brought into the Superior Court of Santa Barbara County where Judge H. S. Gans, of Tehama County, was presiding. As-

suspended for two years pending no further pollution occurs.

The South Mountain property of the Texas Oil Company near Santa Paula, Ventura County, was inspected. No evidences of pollution could be noted and on reliable information it is known that effective measures were taken by the company during a recent storm to prevent any oil from escaping. This was in accord with their promises and desires and another worthy instance of cooperation on the part of the oil industry.



FIG. 88. Official inspection of opening of Santa Fe Springs Waste Water Disposal Company, March 20, 1929.

sistant attorney Ralph W. Scott and Clarence S. Ward, district attorney of the county, successfully prosecuted the case, and Judge Gans enjoined the defendants from future pollution of the waters of the state. The court gave the defendants 90 days to clean up their property.

A complaint was filed against the superintendent of the Marland Oil Company, of Seal Beach, Orange County, for permitting oil to escape into the San Gabriel River. The defendant was brought into the court of Judge Cook in March and fined \$200, \$175 of which was

Inspections have been consistently made of fish screens. In a number of instances, new screens have been installed as a result of efforts of the bureau, and old ones caused to operate more efficiently.

A new screen was installed by the Pacific Gas and Electric Company at the point of their diversion on North Battle Creek, Siskiyou County.

A fish screen was installed by the Deer Creek Irrigation District, Tehama County, on its ditch diverting water from Deer Creek.

The Santa Rosa Water Works has installed a fish screen on its diversion from Santa Rosa Creek, Sonoma County.

Inspections of fish ladders maintained by large operators throughout the most of the area adjacent to the San Joaquin Valley have been conducted. Several of the ladders in the northern and southern parts of the state have also been examined.

The Folsom Dam and fish ladder on the American River has been examined. Assertions have been made that fish do not and can not use this ladder. Nevertheless, authentic reports are on file that fish have already ascended the ladder this season.

The Lassen Irrigation District has installed a fish ladder on its dam maintained in the Susan River. This will permit fish hereafter to reach breeding grounds in the waters tributary to this river.

Bureau of Publicity

During the past year the bureau has functioned along the lines prescribed at the time it was established. Gradually, a sentiment favoring the intelligent conservation and protection of fish and game has been built up throughout the state, and the fine support given this bureau through the press associations and newspapers has had much to do with the public's appreciation of the need for this program of progress.

In addition to sending out numerous publicity stories regarding activities of the division, arrests, convictions and the notable cases made by field forces, numerous visits have been made to other sections of the state, where it has been found that fish and game laws are rapidly becoming more popular.

An average of twenty-one stories per month are broadcast to newspapers. Clippings show the ready response given fish and game matters, as over one-third of the fish and game stories used in the various newspapers in the state are those sent out by the bureau.

Bureau of Game Refuges

New legislation passed by the forty-eighth session of the Legislature revises the fish and game district act. Wherever possible, natural boundaries, instead of section and township lines, have been selected. Three new areas are set aside as game refuges; two existing refuges that

time and adequate investigation have proved badly located are released.

The boundary line of fish and game district 2½ has been reposted by survey made by A. D. McLellan. Some of the refuges near San Francisco have also been posted as well as the Stanford Refuge 3G.

The Governor's advisory committee on game refuges and public shooting grounds has been considering the purchase of waterfowl refuges in the San Joaquin and Sacramento valleys, and a number of refuges have been examined with the view to their purchase. The committee plans to visit the southern part of the state to give consideration to areas that have been recommended.

A more exact knowledge of the nature and extent of breeding grounds for waterfowl in the state is necessary. It is known that several species of duck, and at least one goose, nest in California. In many parts of the state, particularly in Siskiyou, Modoc and Lassen counties and in the Sacramento and San Joaquin valleys, there are quite extensive areas, but it is not known definitely how many nests there are to the square mile in these areas. When such information as this is obtained, it will be possible to regulate the kill better.

During February, 38 claims for the bounty paid by the Division on mountain lions were made. Nine of these lions were killed by official lion hunters of the state.

Operations were carried on in southern California during this spring, due to the fact that in the summer months the heat and dry conditions make it impossible for the dogs to work. Between January 1 and April 12, mountain lion control in southern California has been more effective than ever before. Twenty-nine lions have been killed in Los Angeles, San Diego and San Bernardino counties. In Los Angeles County, during the 22 years that the Division has been paying a bounty on lions, only 89 have been killed and 71 in San Diego County. Since January to April 12, 130 have been submitted for bounty, 49 of these being killed in March alone.

The average number of lions killed since 1907 has been 235 a year. During the first three months of this year claims on more than half this average number have been paid.

During April, 36 claims on lion hides

were made. There were twelve males and twenty-four females.

Counties where most of the lions have been killed, January 1 to April 30, are as follows: Trinity, 22; Madera, 20; Los Angeles, 18; Lake, 15; San Diego, 14; Shasta, 10; Humboldt, 10; Mendocino, 10, and Tehama, 8.

Bureau of Fish Rescue and Reclamation

The installation of the large retaining tanks at Elk Grove, Sacramento County, is progressing rapidly. There are five double tanks of two units, 14 feet long, 48 inches wide and 30 inches deep, sufficient to hold and maintain 15,000 fry and as many adult fish. Each of the species will be kept separate as in a trout hatchery, ready for distribution.

The location of the holding tanks is within a radius of from three to fourteen miles from where 75 per cent of all the spiny-rayed fish were rescued last season. It is also within a short distance from the railroad depot where the fish distribution car takes on the shipment on its regular trips north and south, thus obviating the necessity of holding the car over while the fish are being caught.

So far this season, none of the streams have overflowed their banks. This means very little rescue work will be necessary from the usual areas as would be the case in a season of heavy rainfall. However, there are many lakes and sloughs that will become dry should but little rain fall, and consequently plenty of fish to rescue.

Bureau of Game Farms

The laying season commenced this spring about ten days previous to that of any former year. The first Chinese ring-necked pheasant egg was picked up on March 7. Fine weather, coupled with adequate means and attention, caused the hens to lay more eggs this spring than ever before during operations at Yountville. The last week of March, 1928, showed but 253 Chinese ring-necked pheasant eggs incubated. At the same time in March this year, the incubator contained 1016 pheasant eggs, and there were on hand 334 eggs awaiting to be set.

Mongolian pheasants and silver pheasants commenced laying the middle of March. The first week of April found the valley quail producing eggs. The week following, the Chukor partridges laid six eggs and initiated the season for this class of birds.

During the week of April 12, the first Chinese ring-necked chicks made their appearance. This hatch totaled 25 birds. Tests made of 4907 Chinese ring-necked pheasant eggs being incubated showed that the percentage of fertility was running very high and averaged about 74 per cent.

The first week of May found a total of 10,002 Chinese ring-necked pheasant eggs on hand and 8062 incubating. Some 1300 chicks had hatched and were being cared for by artificial brooders or domestic mothers.

The second consignment of Hungarian partridges arrived at San Pedro March 8. This shipment brings the number of birds brought in this season to 588 pairs. The importations are in large part due to the enthusiasm of Commissioner George B. Clarkson.

Persistent efforts to comply with the most scientific and modern improvements has resulted in the trying out of an electric brooding system. This consists of nine compartments, 8 feet by 13 feet. Completely equipped with heating units and constructed according to the most up-to-date standards, these brooders have been the focus of much attention and interest. If successful, they will solve many problems which have made for difficulties in the past and will permit better results to be gained.

Tests were first made with bantam chicks. The first hatch of Chinese ring-necked pheasants to be tried came through in fine shape. Only three birds out of a lot of 407 died. A second hatch was placed in the new brooders during the last week of April. These passed through the critical stage successfully. The mortality with this second group of birds was exceedingly small and the young pheasants' development was normal. Other tests, however, are necessary before the effectiveness of these brooders for pheasants will be definitely assured and plans for their use on a more extensive scale can be carried out.

The brooders seem to be equally useful with wild turkeys. One batch placed in them made an excellent showing.

The site of the new game farm for southern California, near Chino, San Bernardino County, was surveyed in March, the farm laid out and the ground leveled. Actual work has been started by the Department of Public Works.

Every attempt will be made to rush construction in order to have the pens available for birds in commencing operations this season.

The wooden pipe which supplies water to the state's holdings in Napa County has been replaced by a new steel line. The wood of the old conveyor had so deteriorated that little water could find its way through it. The new line, besides affording a good supply of water for domestic use, affords greater protection against fire. Indeed, a recent visit of the custodian of state property brought compliments concerning the special attention which is being paid on the farm to safeguard against fire.

A case containing 360 Chinese ring-necked pheasant eggs was shipped late in April to the Fish and Game Commission of Hawaii. This was in fulfillment of a promise made to a member of the commission paying a visit to the farm last winter.

Shipments of wild turkey eggs have also been made to the Upland Game Bird Committee of the local sportsmen's association at Oroville. The birds when hatched are to be reared and released by the association.

Chinese ring-necked pheasant eggs have been supplied to the Fitzhugh Ranch at McCloud, Siskiyou County. The birds raised last year on this place were well cared for and the venture eminently successful.

These shipments to individuals in California are departures from the general plan. The state has undertaken to rear large numbers of pheasants within a

definite area under technical and uninterrupted supervision. However, every private effort to increase the output of game birds for liberation in upland covers is deserving of recognition and encouragement. On a few occasions (when there has been a surplus of eggs) assistance has been rendered those who possessed the facilities and had adequate means for hatching and rearing birds.

Requests for information on game bird farming are becoming numerous and insistent. These attest an increasing interest over the entire state. One of the oldest duck clubs in the Sacramento Valley is rearing pheasants this year. The Westwood Rod and Gun Club have purchased 300 eggs from a private farm in Silverton, Oregon.

Five pens of exhibition birds were supplied for the game farm set of the Division's exhibit maintained at the San Francisco Pleasure Boat Show, April 27 to May 4.

A breeding pen of Chinese ring-necked pheasants and one of California valley quail demonstrated the two upland game birds in which sportsmen are most interested. The other three pens, however, came in for the most attention. Due to the universal interest in young life, the enclosures containing week-old Chinese ring-neck pheasants and two week-old wild turkeys with their domestic mothers never failed to attract the crowds. The fifth pen proved a source of much amusement. Here, for the edification of the spectators, a mother mallard reviewed all the defense tactics employed by her species and with nervous, jealous care shepherded her eighteen ducklings about the safer parts of the pen.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor

AN ACT REGULATING THE PACKING OF SARDINES IN MAINE

On April 13, 1929, the State of Maine passed an act to regulate the quality of sardines packed in that state. The act requires that canners be licensed and pay a fee of fifty dollars for each group of buildings constituting a packing plant, for the season from April 15 to December 1, and gives the State Commissioner of Agriculture regulatory power. He is empowered to make uniform regulations to insure that the sardines are packed in conformity with the provisions of the Federal Food and Drug Act and the Food and Drug Act of the State of Maine, and are thus labeled. He may suspend or revoke—subject to previous hearing and subsequent appeal—licenses for violations of any of the regulations. Violations of the regulations concerning packing or operating without a license make the violator subject to a fine of five hundred dollars and imprisonment in jail for not over six months for each and every offense. Municipal courts shall have jurisdiction over this matter.

The Commissioner of Agriculture shall employ inspectors in sufficient numbers to insure adequate inspection. The duties of an inspector are defined and the packers must pay monthly 1 cent for each case of sardines packed as a part of the license fee, to defray the cost of inspection. Provision is made for inspecting sardines packed previous to the time of this act so that they may be labeled under its provisions.

For the purpose of this act the term "sardine" shall be held to include any small, canned clupeoid fish being the fish commonly called herring, particularly the *Clupea harengus*. The minimum count of fish per one-quarter size keyless can shall be five fish. The minimum quantity of oil shall not be less than four pounds per case of one hundred one-quarter size cans. The oil shall be a grade not less than "prime summer yellow." The minimum count for one-quarter mustard pack shall be four, and the quantity of sauce eight pounds per case. Tomato sauce must be 1.035 specific gravity; eight pounds are required per case. On all one-quarter size cans there shall be used a compound lined gasket or other adequate gasket, or such other adequate device as will hermetically seal the container. Packs not conforming to these regulations

must be plainly and conspicuously marked that they do not conform to the regulations. In such cases they shall not be deemed misbranded under the Maine Act.—*Fishery Science and Trade*, Vol. 1, No. 5.

STEELHEAD TROUT APPEARING IN SOUTHERN CALIFORNIA

The Torrance *Herald* of April 27, 1929, records the catching of a steelhead, erroneously called a salmon, by a Los Angeles angler, from a barge off the coast at Redondo Beach. The article remarks on this unusual catching of steelhead in this locality, however, stating that there have been six taken at the barge during the period, April 21 to 27.

Captain Larson, a fisherman of many years' residence at Redondo, stated, when questioned about the catches of steelhead trout, that last year a great many of this species were taken at the barges and several this year. Captain Larson said it has only been in the last three years that steelhead trout have been caught in this region. According to Captain Larson, these fish are taken with hook and line, using anchovies and sardines as bait, this being the same method as is used when fishing for barracuda, mackerel and halibut.—G. Houghton Clark, California State Fisheries Laboratory.

OYSTER CULTIVATION ON PUGET SOUND

On the coast of Puget Sound, in the state of Washington, oysters are now successfully raised from seed imported from Japan. The seed is planted in specially dyked flats. Near Bellingham, Wash., tide-flat operators of oyster beds harvested bivalves at the rate of \$500 worth a day. These Japanese oysters grow as much in three months on the shores of Puget Sound as an Eastern oyster grows in four years. They have to be picked early, because consumers do not fancy grown ones. Choice specimens gathered recently measured ten inches long, and weighed in excess of one pound each. It has recently been discovered that the imported oysters will spawn in the waters of Puget Sound, and it is therefore probable that in a few years the industry will be carried on entirely in American waters.—*National Industrial Review*, San Francisco, Vol. 3, No. 29, May 11, 1929.

CANADA TO STUDY PACIFIC PILCHARD AND HERRING INDUSTRIES

A commission appointed by the Dominion and Provincial governments will shortly make an investigation of the pilchard and herring fishing industries in British Columbia, according to information furnished the Department of Commerce by American Consul H. S. Tewell at Vancouver, B. C. Comparatively little is known concerning pilchards, and since the government granted permission to use this species in the production of fish oil and meal in 1925, large quantities have been caught for use in building up a fish reduction industry on Vancouver Island whose annual production is valued at \$2,000,000. The total catch of pilchards in 1924 amounted to 2,748,500 pounds and in 1928, 141,580,300 pounds. Fear has been expressed that at this rate the supply of pilchards may become depleted, and for the protection of the fish reduction industry it has become necessary to procure a more scientific knowledge of the fish upon which the industry depends. Herring have been used in the manufacture of fish oil and meal since 1927, the catch devoted to this purpose in 1928 being 10,064,500 pounds. In view of the food value of this species, it appears to be desirable to know something more of the probable size of the source of supply, and pending an investigation, permission has been withdrawn to use herring in the fish reduction industry.—"Foodstuffs 'round the World." *Fishery News*, May 17, 1929.

SEA LIONS AND FISHERMEN

The following rather jocose letter, dealing with sea lions and their relationship to fish, appeared in the Leeside column of the Los Angeles Times of May 3, 1929:

"Leeside: I see that the commercial fishermen want to slaughter all the sea lions because they are 'destroying \$100,000 worth of fish daily.' Also that the Legislature wants to put a curb on the fish canneries because so many tons of the larger size sardines are being made into fertilizer daily, to which the canneries retort that the fertilizer business is no menace whatever to the fish supply.

Also that State Fish and Game Commission figures show that in one month approximately 50,000,000 pounds of commercial fish came in over the fish wharves at San Pedro alone. It is appalling to think that in only 10,000 to 50,000 years the sea lions, natives of these waters, have so depleted the supply that now the commercial fishermen, who are not natives but mostly came here from foreign lands only a few years ago, can catch only a meager 50,000,000 pounds of fish monthly. So I think it high time the sea lions were destroyed, as, at the present rate, they might seriously diminish the tonnage of fish in southern California waters in another million years or so. And also to save these native sea lions from the sad fate of being starved to death by the foreign fishermen."

Although written in a sarcastic vein, the writer has hit one of the substantial points regarding the position of sea lions in the natural balance. Not so many years ago the principal food fishes were numbered by millions where there are thousands today. During the same period there were ten thousand sea lions where one exists now. The old state of affairs ran a smooth course for many thousands of years, until man discovered that fishing was profitable. It is rather inconsistent, therefore, to blame the sea lions for the decrease of the fish. A more logical supposition is that man has caused the decrease of both fish and sea lions.

An observation made some years ago at the mouth of the Klamath River is very much to the point in this regard. Several sea lions were killed in the Klamath River estuary during the height of the salmon run. On opening them the stomachs were found to be filled with lampreys. It is a proven fact that lampreys are detrimental to other fish, killing great quantities of them in some places. That sea lions eat salmon and other food fish is a fact which can not be questioned; but that they also destroy vast quantities of fish and other organisms which are detrimental to these same food fish is also becoming to be accepted by scientific men.—Paul Bonnot.

LIFE HISTORY NOTES

WEED BURNING AND TULE LAKE PHEASANTS

The bulk of the pheasants in the Tule Lake region, both California and Oregon, make their first setting of eggs on the weed covered ditch banks in late March or early April. The surrounding fields are bare and void of protective cover for any nesting ground birds. At this time of year (late March and early April) the United States Reclamation Service starts its ditch riders with a helper or two cleaning ditches. Dry weeds are fired.

them out, and then, if they nest again on a check, the mowing of the first crop of alfalfa destroys the nest. By this time there is sufficient cover on the ditch banks so they can eventually raise a brood. In short, the destruction of settings or partial settings is enormous. It amounts to possibly 75 per cent of the total settings.

All this can easily be avoided if the ditches are fired early in March. However, the Reclamation Service ditch riders are temporary employees. May 1 is the official date for turning water into the



FIG. 89. Burning off hundreds of acres of unharvested grain affording excellent cover for Chinese ring-necked pheasants, Tule Lake, Modoc County. Photographed by E. S. Cheney, May 12, 1929.

Weeds in the water are dragged out on the bank and fired after drying.

Pheasants that nest early and before there is any growth in the fields of new grain or alfalfa are burned out. Their nest sites are destroyed sometimes two or three times when they persist in nesting on unburned ditch banks. If they double back and nest in a weed patch that has escaped fire they are in the clear. If they keep getting driven away from the nest sites on the ditch banks until the fields have enough crop growth to furnish cover, irrigation in May will usually drown

ditches of the Klamath Project. Actually this date varies from the first or the last week in April to the end of the first week in May, according to conditions of soil moisture. Now the ditch cleaning job consumes at least a month. Therefore, the ditch riders are employed one month ahead of the time their water patrol duties commence and continue on until the water is shut off late in the fall.

In many instances private owners burn the weeds on their property earlier than the Reclamation Service. Because of this pheasants nesting on their property have

more favorable chances of bringing forth a brood.

In 1925, on one side of the ditch on the Dalton Ranch, I counted twelve burnt settings in one and one-quarter miles of ditch bank. In 1926, along the main canal from Malin to the highway, I counted ten destroyed settings within a distance of two miles on one side of the ditch. In 1927, along the ditch that serves the farms east of Lost River and nearest to it, I counted eight destroyed settings in less than three-quarters of a mile of ditch, and last year in the same place, nine destroyed settings. All these settings showed signs of being burnt. None showed evidence of having been ruined by cats, dogs or predatory animals.

Burning started last week this year, but had to be abandoned on account of storms which have so wet the weeds that they will not burn. It will be continued as soon as the weather clears. Consequently, my count for this season is yet incomplete. On the whole this procedure effects an utterly useless loss of potential game and economically useful birds. Furthermore, the loss is entirely avoidable if the Reclamation Service could be induced to burn the weeds earlier.—Fred R. Starr, Macdoel, California, April 7, 1929.

SOME EARLY PLANTINGS OF TROUT

The Sierra Club planted eighty-one trout in Moraine Lake, Tulare County, during July of 1908. These trout were taken from the Kern River and were the Kern River variety of rainbow trout. They averaged six to eight inches in length. In 1912, trout were caught in Moraine Lake which were unquestionably these same fish. They weighed from six to eight and one-half pounds. The largest one caught was twenty-eight and one-half inches in length. These fish were identified as being the same fish by Prof. C. A. Kofoed of the University of California, who had a special high-powered microscope and who came along on the trip especially to study the age of trout. The fact had just been established in connection with salmon fisheries that the age of fish of this character could be determined by the annual growth of their scales as indicated by groups of rings under the microscope. The largest fish I caught was eight years of age. The first four years showed a comparatively small growth annually, and the last four years, a very exaggerated growth. This was the period of time the fish were in the lake and indicated that conditions in the lake

were highly favorable for the growth of trout.

Four years later, or in 1916, we again visited Moraine Lake and although we saw one or two very large trout, which were evidently the same ones we had planted in 1908, we were unable to catch any. We did, however, find a trout in the shallow part of the lake that had evidently been dead for two or three days. It weighed between eleven and twelve pounds. The remaining fish we saw in the lake seemed to be about the same size. We observed these fish and they seemed to be feeding on small larvae found in the water, many of which were evidently mosquito larvae.

In 1908, the club planted golden trout of about ten inches in length, taken from Rock Creek, Tulare County, which we planted in an unnamed lake near by. In 1912, four of us visited this lake and we each caught two of these golden trout. The largest one which I caught weighed three and a half pounds and was about eighteen inches in length. It was a very heavy, chunky fish. The meat was reddish pink in color. Dr. David Starr Jordan told me that the meat of any trout will turn pinkish or reddish if it has a superabundance of food, this being an indication that the trout is very fat. That is why salmon that are fresh run from the ocean and in perfect condition have very red meat. This gradually fades until it is almost white when the fish reaches the upper Sacramento. Salmon cease feeding as soon as they leave the ocean and by the time they near their spawning beds have lost all their fat.

These large golden trout had changed color somewhat, and were reddish instead of golden. They also had the same absence of scales which characterizes the golden trout, and were great fighters.—Wm. E. Colby, Mills Building, San Francisco, California.

PELICAN SWALLOWS LARGE STRIPED BASS

On the morning of November 27, 1928, Deputy William Armstrong and myself were returning to Deputy Armstrong's ark in Goodrich Slough in the patrol boat *Hunter*. Upon rounding the point below what is called "Sixth Reach" Slough, we saw a large white pelican struggling in the water as if wounded or in distress. We observed that the bird had caught and was trying to swallow a good-sized fish. It tried to fly as we drew nearer, but the excessive weight of the fish pulled the bird's head down. The bird apparently was utterly without power to lift itself into the air while in

this position. After each attempt it seemed quite exhausted and was unable to keep its head from sinking into the water.

Finally, after several violent efforts it succeeded in swallowing the fish. It was about to make off as I shot it. On cutting the pelican open we found that the fish was a striped bass, which we removed and took to Vallejo where it was weighed. The fish tipped the scales at four pounds eight ounces.—Charles F. England, Vallejo, California.

ANTELOPE IN KERN COUNTY

In 1859, my father hauled hay from the plains south of Bakersfield to Fort Tejon, where it was sold to General Albert Sidney Johnston, later killed in the Civil War at the battle of Shiloh. The hay consisted of alfalfa (*Erodium*), which the Indians cut with shovels. It brought \$75 per ton, delivered by ox teams at the fort. The wild oats grew everywhere, shoulder high, but were not used for hay.

The little creek which spread out in the plains below the fort ran water at night, but soon dried up under the sun's heat. Antelope, by the hundreds, came trooping in from the plains to this water. This opportunity was too tempting to an old trapper and hunter, who accordingly placed a brush ambush close to the watering place, and during the days following slaughtered over 5000 antelope.

The hides only were taken, and the carcasses left to rot.

Grizzly bears were also very numerous and savage. It was not safe to travel certain trails after dark, as the bears would sometimes attack men even on horseback. The last grizzly has long since been killed. I am told that the automobile is responsible for chasing almost the last of the surviving antelope to death.

Antelope still survive in portions of California, from which other herds could be built up if proper protection were afforded. Could not the Sutter Buttes, in the center of the Sacramento Valley, an area without agricultural future, be reserved as an antelope refuge for all time?—W. W. Mackie, College of Agriculture, University of California, Berkeley, California.

LACK OF FOOD CAUSES LOSS OF DEER

I was patrolling in the Bishop Creek country recently and the deer are there by the hundred. I noticed at least a hundred dead ones, but no fresh ones. I am of the opinion that the feed was short there during the winter and that accounts for most of the dead. The feed is getting good there now, but the deer are keeping it down close. The deer are not wild at all, they even come to one's camp to get salt.—C. L. Brown, Mariposa, California, May 13, 1929.

CONSERVATION IN OTHER STATES

LOUISIANA BEGINS FISH CULTURE

In states like Louisiana, where water temperatures are uniformly high, fish culture is impractical according to methods used in cold water hatcheries of the north or colder latitudes. However, pond culture of the warm water nest-building fishes is being practiced very successfully in the south.

The Conservation Department of Louisiana has just announced the planting of 2,500,000 game fish reared during the past season in the Cool Coosa fish culture station of that state. The success of this project during the first year of its operation far exceeded the expectations of the department. Of the fish reared and planted 2,000,000 were bream or sunfish, sometimes called perch in the south; 400,000 were large-mouthed black bass and 100,000 crappie and barfish or white bass. The

production was over 200,000 fish to the acre, the pond in which they were reared comprising twelve acres. It is of interest to fish culturists to know that such a large number of fish can be reared in a pond of that size and retained until over nine months of age. Some of these fish had attained quite remarkable size; for instance, some of the bass weighed as high as a pound and a quarter each.

A new accomplishment of this station was the rearing of white bass successfully under hatchery conditions.

The fish in this hatchery were not fed artificially, but by providing certain fertilizer encouraging the growth of plant life and natural insect food, the natural supply of food was maintained in abundance. The project cost the state only \$3,550 for construction and the cost of its operation during the year was nomi-

nal. It is entirely probable that the success of this enterprise will result in the establishment of numerous other similar ones in other parts of that state and elsewhere.

MICHIGAN MAKES IMPORTANT PURCHASE

The Michigan State Department of Conservation has been authorized to spend \$20,000 of its game protection fund for the purchase of 5000 acres of land in Otsego and Cheboygan counties to block in the Pigeon River Forest and Otsego Game Preserve. The purchase of this land will give the department control of nearly twelve miles along the Pigeon River, one of the state's finest fishing streams.

NEW YORK'S NEW GAME SANCTUARY

"Conservation Commissioner Alexander Macdonald has entered into a contract and sent to the Department of Law for title examination for the purchase of a tract of approximately 2000 acres for additional demonstration forest and game refuge purposes to be known as the East Hill Demonstration Forest and Game Refuge.

The tract in question lies in the towns of Ossian, Nunda and Grove, in Livingston and Allegany counties, and is located generally on the ridge between Sugar and Canaseraga creeks, approximately six miles northwest of the village of Canaseraga and about the same distance southeast of the village of Nunda. The elevation ranges from 1700 to 2000 feet. Approximately one-half of the area is abandoned farm land. The remaining portion is covered with second growth forest. Included within the area under contract is a three-year-old plantation of white pine approximately 60 acres in size. It is expected that other adjacent lands will be acquired at a later date.

This purchase area is the fifth purchase area to be established for demonstration forest and game refuge purposes outside of the so-called Forest Preserve counties.—*Dupont Promotion News Bulletin*, No. 29, March 14, 1929, p. 9.

A GAME CENSUS IN NORTH CAROLINA

In order to obtain information regarding the amount of game in the State of North Carolina, its distribution, and for the solution of game problems, a census of game killed the first year of enforcement of the law was taken in 1928.

Return cards were mailed to the 139,170 hunters, and on the basis of replies from approximately 40 per cent, it is

estimated that the value of flesh and furs of birds and animals killed annually in the state amounts to approximately \$2,000,000. The total estimated kill of birds and animals for the year was 4,529,590.—*Conservation and Industry*, Raleigh, N. C., p. 4.

GEORGIA STILL LACKS ANGLERS' LICENSE

Georgia is one of the very few states in the union that does not require a license for fishing in her public streams. The fishermen of the state do not contribute one penny to be used for protecting and propagating fish. Practically every cent of revenues collected by the Game and Fish Department is paid by the hunter through the purchase of hunting licenses.

PUBLIC SHOOTING GROUNDS FOR ILLINOIS

In view of the fact that practically all the available shooting ground along the Illinois and Mississippi rivers is leased by gun clubs or private individuals, state conservation officials of Illinois recognized the need of land for the use of public shooting grounds and upon which anyone could hunt. The Illinois Department of Conservation has started two such places, one at Sparland, covering 760 acres of land, and one across the Illinois River from Rome, covering 1720 acres of land. These tracts represent the first example of the state's taking over this kind of land which seems to be more valuable for its game resources than for agriculture, especially with the high drainage taxes, and it is planned from time to time to create additional areas upon which sportsmen can feel free to hunt and fish.

MICHIGAN CONTINUES ITS "CREEL CENSUS"

The Department of Conservation will continue the "creel census" during the present year in connection with its program for assembling definite information on various matters relative to inland fisheries. Conservation officers are supplied with creel census cards, and it is expected that the sportsmen will willingly cooperate with the "census taker" in furnishing reliable information on which to base reports. The cooperation received during the past two years in this work has been most gratifying to the department.—Michigan Department of Conservation.

NORTH CAROLINA BREEDING FUR-BEARERS

With fur-bearing animals having been added to the breeding stock at the State

Game Farm, near Asheboro, North Carolina, the field of operation of the institution is being extended.

The latest comers at the State Game Farm are twelve muskrats, six brown and six black. For several weeks the force at the game farm has been busy preparing pens, twelve for the muskrats, four large pheasant pens, twenty-one for quail, and fifty setting boxes for the last named birds.

Muskrat breeding at the farm will serve the purpose of providing stock with which to rehabilitate animals in sections where they have been depleted and to demonstrate the practicability of breeding fur-bearers in captivity in North Carolina. If this experiment proves successful, it is contemplated that mink may be added to the stock at the farm, and later perhaps other animals, including the beaver and otter, two of the most valuable of all fur-bearers.

Special attention is to be given by game authorities to building up the fur industry in North Carolina, and it is believed that several million dollars can be added to the income of trappers annually by this program.—*Conservation and Industry* (North Carolina Department of Conservation and Development), Vol. 6, No. 7.

BEAR REGARDED ASSET IN WYOMING

Wyoming is one of the few states that requires a license for shooting bears. That state regards the bear as a game animal and a distinct asset. In 1927 Wyoming sold 392 resident bear permits and 53 nonresident permits. During the 1928 season 465 resident bear permits were sold and 51 nonresident.

A game census is taken annually in Wyoming, the result of the last census disclosing the following number of the principal game animals in the state: Moose, 5061; elk, 33,240; mountain sheep, 1635; antelope, 21,690; deer, 21,650; bear, 1595. The quantity of game killed during the season of 1927 is reported as follows: Elk, 1191; deer, 1254; bear, 77; mountain sheep, 22; antelope, 307; grouse, 7180; sage hens, 88,783.—*The American Field*, April 20, 1929.

PHEASANT SURVEY

The University of Nebraska has announced that it will conduct a twelve months' investigation on the feeding habits of the Chinese ring-necked pheasant. It is planned to observe the birds during a period of twenty-four hours for two days each month. At specified times specimens of killed birds will be for-

warded to the university laboratory for examination and analysis of stomach contents. This survey will also make a study of the relation of the pheasant to other game birds and to domestic fowl.

QUESTIONNAIRE OF GAME CONDITIONS IN NEW JERSEY

Protector J. M. Stratton sent a questionnaire to the wardens respecting game conditions for the following game: Rabbits, pheasants, quail, ruffed grouse, woodcock, squirrels, ducks, geese, brant, Wilson snipe, yellow-legs, rails, Hungarian partridge, the questions being as follows:

Was there good supply of each at beginning of season?

Was there increase or decrease in each killed over former years?

Were hunters pleased?

Were there many cases where bag limit was secured for each?

Was there good hunting for each throughout season or only first few days?

Is each increasing or decreasing? (Give special attention to woodcock and Hungarian partridge.)

Amount of each left over.—Annual Report of the New Jersey Board of Fish and Game Commissioners, for the fiscal year commencing July 1, 1927, and ending June 30, 1928.

OKLAHOMA STATES PLANS

The Game and Fish Commission of Oklahoma plans for the succeeding biennium:

1. A new state fish hatchery to serve the northwestern tier of counties.

2. Purchase of additional lands for state park and game preserve purposes.

3. Creation of additional game refuges upon which can be placed sufficient quantities of wild game for breeding and restocking.

4. Publication of a department magazine or news sheet.

5. Construction of more than 100 local fish hatcheries and nursery ponds.

6. An enlargement campaign in co-operation with the Federal Government, to rid the state of predatory animals.

7. Purchase and distribution of bob white quail and other wild game in as large quantities as finances will permit.

8. Establishment of a state park system to keep pace with modern recreational demands.

9. To urge passage of such laws as will correct defects which may have existed during this biennium and adoption of such rules and regulations as will make more popular the great work now being conducted.

10. More rigid enforcement of existing game and fish laws where such may be necessary.

11. Cooperation with organized groups of sportsmen and creation of local advisory boards in each community, to aid in a more successful administration of department laws, rules and regulations.

12. Improvement of hatchery properties, game preserves and recreational centers to the end that pride and pleasure may be realized by the citizens of Oklahoma and by the visitors who enter her borders, as well.—Report State Game and Fish Commission, State of Oklahoma, Bienium, July 1, 1926, to June 30, 1928.

WISCONSIN GIVES PUBLICITY TO VIOLATORS

The Wisconsin Conservation Commission has recently decided to give publicity to successful prosecutions for violation of the fish and game laws of that state. It has been found in several states where this policy has been followed that publicity tends to reduce the number of violations as many who do not experience any compunction of conscience or feel a monetary penalty dislike very much the unfavorable notoriety which attends the publication of facts in connection with their prosecution.

Wisconsin will publish not only the name and address and the character of the violation in each case but the "pedigree of the violator, giving his previous record in connection with violations, if any, also facts with reference to his membership in sportsmen's clubs.

This policy will doubtless reduce the number of repeaters.—American Game Protective Association.

NEVADA ANTELOPE TO BE STUDIED

Since the acquisition, some time ago, by the Audubon association of a tract of land in Nevada to be used as a sanctuary for antelope, it has seemed desirable to make an intimate study of the habits of these animals, particularly with respect to their numbers, enemies and migratory movements. It has long been known that there is quite a divergence between their summer and winter ranges, but apparently no definite information exists on the subject with respect to antelope of this particular region. In order to obtain exact data the association through the generosity of two of its members, Dr. John C. Phillips and Childs Frick, has been enabled to employ a field man who has begun a year's intensive study of the antelope inhabiting north-eastern Nevada. He is equipped with both a horse and a motor car and in this

way will be able to follow the antelope in all their movements. Careful counts are being made and more than 1000 antelope have been thus far reported. It is hoped to acquire a fund of information which will be of very great value in determining the character of administration the sanctuary should receive. Mr. Emerson, the agent, has also been made a game warden by the state conservation authorities. The area inhabited by the antelope is also the heart of the sage-hen country, and observations are also being made concerning the status of this interesting and picturesque grouse. Emerson states that he has found abundant evidence to show that ravens are very destructive to the birds. The Last Chance Ranch and its environs is controlled by the Audubon association, with an option to purchase.—*The American Field*, March 23, 1929, p. 282.

PHEASANTS ON INCREASE IN NORTH DAKOTA

The State Game and Field Commission of North Dakota has been more than enthusiastic over the results obtained in the propagation of Chinese pheasants. The southern part of the state is well stocked and the Commission contemplates trapping a few thousand in that locality for shipping and distribution all over the state. The stock from 7000 pheasants released from 1913 to 1917 increased to such a number that ten years later in 1927 over 2,000,000 pheasants were killed with no noticeable decrease. This remarkable fact is due, no doubt, to the climatic conditions of the state, the severe winters eliminating the weaklings and leaving only the strongest birds for breeding stock. Our state has practically the same climatic conditions as South Dakota and the geographic features are very similar, giving us ideal conditions under which to propagate this bird.

In planting the pheasant it is very desirable to have a locality where there is plenty of water and some protection. It is a good plan to have some farmer feed and encourage the birds to inhabit the place of their original planting and to let them gradually spread out through the surrounding country as they multiply in number.

There has been much argument pro and con as to whether the Chinese pheasant is desirable for the farmer. When these birds were first released many complained, saying that they were destructive. The corn fields were said to be damaged as the birds seemed to inhabit them in preference to other fields. This caused the Commission to hesitate some in the

encouragement of the propagation of this species until thirty pheasants were killed in the corn fields in the spring under special permit and it was found that only two had corn in their crops and that the remainder had been feeding on cut-worms. Since that time the farmer has learned for himself that the presence of the pheasant is a benefit rather than a detriment and in the majority of cases, he is now encouraging their propagation.

In a few years North Dakota will be stocked with Chinese pheasants, a fine "table" bird and one excelled by few in giving real sport to the hunter.—Tenth Biennial Report State Game and Fish Commission of North Dakota.

WASHINGTON TAKES INVENTORY OF WATERFOWL AREAS

No merchant can be certain that his business is operating at a profit unless he knows the amount of his stock of goods and its condition. Similarly, it is necessary to take an inventory of game and game conditions in order to gain a knowledge of its actual status.

The Division of Fish and Game of Washington is applying this principle in attempting to arrive at a more satisfactory solution of its migratory waterfowl problems. It is making a survey of the present and former known areas resorted

to by migratory waterfowl as loafing, feeding and breeding grounds. The information considered essential to the success of the survey is outlined as follows:

- I. Present waterfowl areas.
 - A. Location and acreage of county-owned areas.
 - B. Location and acreage of state-owned areas.
 - C. Location and acreage of privately-owned duck club areas.
 - D. Nature of natural feed in each area.
 - E. Species of waterfowl frequenting areas.
 - F. Decrease or increase noted in numbers.
- II. Areas no longer used by waterfowl but which might be restored.
 - A. Location and acreage of county-owned areas.
 - B. Location and acreage of state-owned areas.
- III. Areas formerly waterfowl lands but reclaimed for agricultural purposes.
 - A. Location and acreage of each.
- IV. Ideas for the development of areas.
 - A. Under this caption include any information which, in your opinion, has a direct bearing on the survey as a whole.

REPORTS

SEIZURES OF FISH AND GAME

January, February, March, 1929

Abalone, pounds.....	561
Abalone.....	902
Barracuda, pounds.....	3,394
Bass, striped.....	33
Bass, black.....	6
Catfish, pounds.....	20
Clams.....	1,628
Crabs.....	248
Cockles, pounds.....	110
Halibut.....	3
Lobsters, pounds.....	1,862
Bluegill, Crappie.....	125
Perch, Sunfish, Smelt.....	62
Salmon roe, pounds.....	300
Sturgeon.....	1
Trout, pounds.....	454
Deer meat.....	1,003
Ducks.....	523
Geese.....	64
Mudhens.....	17
Non-game birds.....	117
Pigeons.....	3
Quail.....	18
Rabbits.....	4
Squirrels, tree.....	3
Sea gulls.....	2
Shorebirds.....	43
Swans.....	6
Bird nets.....	8
Dip nets, set lines.....	16

VIOLATIONS OF FISH AND GAME LAWS

GAME CASES

January, February, March, 1929

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Violations of Hunting License Act.....	83	\$1,650	-----
Deer meat: closed season.....	40	2,001	362
Deer: fawn, doe; closed season.....	10	1,534	120
Ducks: overlimit; closed season; selling of.....	31	1,230	25
Geese: overlimit.....	1	40	-----
Quail: closed season.....	3	125	-----
Pigeons, doves: closed season.....	3	60	-----
Swan: illegal killing of.....	6	255	-----
Shore birds: illegal killing of.....	3	75	-----
Non-game birds.....	46	1,525	-----
Pheasants: illegal possession of.....	4	500	-----
Mud hens: closed season.....	8	75	-----
Rabbits: closed season.....	4	100	-----
Squirrels, tree: illegal possession of.....	6	150	30
Night shooting.....	9	125	100
Shooting from power boat and auto.....	5	180	-----
Firearms in game refuge.....	3	75	-----
Bird nets, traps: illegal.....	3	100	-----
Fur trapping regulations: no license.....	9	175	-----
Refusal to exhibit game birds.....	1	300	-----
Trapping game birds.....	1	25	-----
Totals.....	279	\$10,300	637

FISH CASES

January, February, March, 1929

Violation	Number arrests	Fines imposed	Jail sentences imposed (days)
Violations of Angling License Act.....	11	\$160	-----
Violations of Commercial Fishing License Act.....	9	195	-----
Abalone: closed season; small.....	79	1,727	5
Barracuda: small.....	4	125	-----
Bass, black: closed season.....	3	65	-----
Clams: small; closed season.....	63	1,460	50
Crabs: small.....	15	270	60
Lobsters: small; oversized.....	12	295	10
Trout: closed season; selling of.....	37	1,055	55
Sturgeon: illegal possession of.....	1	250	-----
Sunfish, catfish: closed season.....	4	70	-----
Cookles: small.....	5	80	-----
Eel: small.....	2	20	-----
Nets, traps, lines: illegal.....	21	1,325	100
Spears, gaff hooks: illegal.....	9	315	-----
Pollution of bay.....	3	425	-----
Night fishing.....	5	100	-----
Totals.....	283	\$7,937	280

STATEMENT OF EXPENDITURES

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal.....	\$12,084 99	\$2 90	\$2,461 84	\$565 75	\$15,115 48
Clerical and office.....	17,224 23	866 78	4,021 89	454 69	22,567 59
Rent.....			6,640 60		6,640 60
Automobiles.....		199 07	200 44		399 51
Telephone and telegraph.....			3,451 97		3,451 97
Postage.....			2,881 81		2,881 81
Freight, cartage and express.....			1,741 57		1,741 57
Printing.....		7,752 85			7,752 85
Accident and death claims.....			5,014 42		5,014 42
Commissioners.....			411 98		411 98
Total administration.....	\$29,309 22	\$8,821 60	\$26,826 52	\$1,020 44	\$65,977 78
Education:					
Director and assistants.....	\$10,515 38	\$363 19	\$2,898 07	\$1,728 01	\$15,504 65
Pacific Southwest Exposition.....	242 75	1,014 06	1,349 13		2,611 94
Total education.....	\$10,764 13	\$1,377 25	\$4,247 20	\$1,728 01	\$18,116 59
Publicity:					
Director.....	\$2,475 00		\$509 62		\$2,984 62
State Fair.....	357 00	\$212 21	730 71		1,299 92
Total publicity.....	\$2,832 00	\$212 21	\$1,240 33		\$4,284 54
Conservation and protection:					
Chief and assistants.....	\$7,524 99	\$39 55	\$1,679 63		\$9,244 17
Clerical and office.....	2,125 00	49 90			2,174 90
Rent.....			265 70		265 70
Automobiles.....		766 45	423 80	\$14 33	1,204 58
Captains and deputies.....	159,647 88	176 29	115,593 88	802 96	276,221 01
Patrol launches.....	1,575 00	1,174 41	1,190 33	422 61	4,362 35
Lion hunters.....	2,332 69				2,332 69
Coyote trappers.....	358 88				358 88
Lion bounties.....			6,280 00		6,280 00
Fish planting.....	1,260 00	801 88	2,317 58		4,379 46
Refuge posting.....	4,736 75	241 17	973 45	3 60	5,954 97
Fish reclamation and rescue.....	505 00		458 22		963 22
Total conservation and protection.....	\$180,066 19	\$3,249 65	\$129,182 59	\$1,243 50	\$313,741 93
Commercial fisheries:					
Chief and assistants.....	\$6,705 00	\$454 77	\$1,521 93	\$499 71	\$9,181 41
Deputies.....	26,401 75	82 46	6,344 67	65 53	32,894 41
Patrol launches.....	2,121 45	1,355 92	1,907 70	22 20	5,407 27
Statistical.....	5,590 00	228 11	341 47		6,159 58
Laboratory.....	27,408 39	1,169 21	5,247 88	812 99	34,638 47
Salmon tagging.....			41 00		41 00
Botulism.....			11,250 00		11,250 00
Automobiles.....		241 37	214 25		455 62
Carp eradication.....	1,485 84	315 10	240 35		2,041 29
Total commercial fisheries.....	\$69,712 43	\$3,846 94	\$27,109 25	\$1,400 43	\$102,069 05
Fish culture:					
Chief and assistants.....	\$3,315 00	\$8 18	\$226 07	\$26 50	\$3,575 75
Clerical and office.....	3,060 67	34 97	218 44	158 55	3,472 63
Rent.....			79 00		79 00
Automobiles.....		2,431 93	1,288 95	52 55	2,773 43
Hatcheries.....	94,843 66	40,024 69	13,793 64	5,656 25	154,318 24
Hatcheries—additions and betterments.....				2,070 02	2,070 02
Special field investigation.....	6,795 00	1 50	2,518 83	7 18	9,322 51
Fish reclamation and rescue.....	2,021 00	71 38	678 17	164 37	2,934 92
Total fish culture.....	\$110,035 33	\$42,572 65	\$18,803 10	\$8,135 42	\$179,546 50
Hydraulics:					
Chief and assistants.....	\$4,305 00	\$264 44	\$1,345 31	\$51 32	\$5,966 07
Cooperative research work.....	2,250 00		134 13		2,384 13
Total hydraulics.....	\$6,555 00	\$264 44	\$1,479 44	\$51 32	\$8,350 20

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Game propagation:					
Game farm—Yountville.....	\$6,995 44	\$5,668 18	\$1,982 82	\$1,936 96	\$16,583 40
Automobiles.....		127 46	66 71		194 17
Southern California Game Farm.....			4 80		4 80
Total game propagation.....	\$6,995 44	\$5,795 64	\$2,054 33	\$1,936 96	\$16,782 37
Research:					
Chief and assistants.....	\$9,090 03	\$422 24	\$1,063 28	\$70 00	\$10,645 55
License commissions.....			\$44,439 35		\$44,439 35
Hungarian partridges.....				\$5,678 30	\$5,678 30
Salinas River channel.....				\$98 37	\$98 37
Total eightieth fiscal year.....	\$425,359 77	\$66,562 62	\$256,445 39	\$21,362 75	\$769,730 53

STATEMENT OF INCOME

For the Period July 1, 1928, to March 31, 1929, of the Eightieth Fiscal Year

License sales:	Detail	Total
Fish breeders' licenses, 1929	\$300 00	
Angling, 1927	1,040 00	
Angling, 1928	357,988 20	
Angling, 1929	12,420 00	
Hunting, 1928	459,821 50	
Hunting, 1929	22,207 00	
Market fishermen's licenses, 1928-1929	31,320 00	
Wholesale fish packers' and shell fish dealers' licenses, 1928-1929	985 00	
Game breeders' licenses, 1928	102 50	
Game breeders' licenses, 1929	627 50	
Fish breeders' licenses, 1928	55 00	
Trapping licenses, 1928-1929	6,479 00	
Commercial hunting club licenses, 1928-1929	2,025 00	
Commercial hunting club operators' licenses, 1928-1929	575 00	
Deer tag licenses, 1928	103,116 80	
Kelp licenses, 1929	10 00	
Market fishermen's licenses, 1929-1930	10,060 00	
Deer tag licenses, 1929	2,518 00	
Total license sales		\$1,011,650 50
Other income:		
Game tag sales	\$35 58	
Court fines	73,463 19	
Fish Packers' tax	144,392 01	
Kelp tax	31 54	
Fish tag sales	5,656 54	
Crawfish inspection	21 00	
Miscellaneous sales	624 89	
Interest on bank deposits	4,344 63	
Contributions from importers	407 18	
Total other income		\$228,976 56
Total departmental income		\$1,240,627 06

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1928

(Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries.)

Canned

Species of fish	Size of cans	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Abalone	1-lb. tall		255			255
	$\frac{1}{2}$ -lb.		80			80
Albacore	1-lb.			8,544	7	8,551
	$\frac{1}{2}$ -lb.			84,977	637	85,614
	$\frac{1}{4}$ -lb.			1,736	14	1,750
	$\frac{1}{4}$ -lb. (96 to case)			3,836		3,836
Bonita	1-lb.			1,417	131	1,548
	$\frac{1}{2}$ -lb.			12,410	3,258	15,668
	$\frac{1}{4}$ -lb.				1,654	1,654
	$\frac{1}{4}$ -lb. (100 to case)			30		30
Fish cakes	1-lb.			2,101		2,101
	$\frac{1}{2}$ -lb.			10,984		10,984
Mackerel	1-lb. tall		1,030	357,136	25,110	383,276
	$\frac{1}{2}$ -lb.			4,717	208	4,925
	$\frac{1}{4}$ -lb.				270	270
Salmon	1-lb. flat	461				461
	$\frac{1}{2}$ -lb. flat	4,124				4,124
Sardines	10-lb.		263			263
	1-lb. oval		1,511,535	945,676	39,755	2,496,966
	1-lb. tall		4,569	9,652		14,221
	$\frac{1}{2}$ -lb. oval		43,754		671	44,425
	$\frac{1}{2}$ -lb. square		159		725	884
	$\frac{1}{4}$ -lb. square		2,232		30,540	32,772
	6-oz. tall (100 to case)		80,252	143,724	1,823	225,799
Shad	1-lb. tall	7,475				7,475
Shad roe	$\frac{1}{2}$ -lb. oval	2,883				2,883
Squid	1-lb. tall		2,056			2,056
Tonno	4-lb. (12 to case)			903		903
	1-lb.			45		45
	$\frac{1}{2}$ -lb.			14,592	221	14,813
	$\frac{1}{2}$ -lb. (50 to case)			3,502		3,502
	$\frac{1}{4}$ -lb.			426		426
	$\frac{1}{4}$ -lb. (100 to case)			86,570	11,562	98,132
Tuna, bluefin	1-lb.			9,929	1,669	11,598
	$\frac{1}{2}$ -lb.			55,411	37,095	92,506
	$\frac{1}{4}$ -lb.			18,535	7,584	26,119
	$\frac{1}{4}$ -lb. (96 to case)					
	$\frac{1}{8}$ -lb. (96 to case)			726		726
Tuna, flakes	4-lb. (12 to case)			1,393		1,393
	1-lb.			49		49
	$\frac{1}{2}$ -lb.			1,726	1,086	2,812
	$\frac{1}{4}$ -lb.			4,728	7,282	12,010
	$\frac{1}{4}$ -lb. (100 to case)				788	788
	$\frac{1}{4}$ -lb. (48 to case)			405		405
Tuna, striped	1-lb.			669		669
	$\frac{1}{2}$ -lb.			6,664	11,740	18,404
	$\frac{1}{4}$ -lb.			45,924	90,160	136,084
Tuna, unclassified	1-lb.			11,473	28,530	40,003
	$\frac{1}{2}$ -lb.			2,147	4,455	6,602
	$\frac{1}{4}$ -lb.			42,595	49,195	91,790
Tuna, yellowfin	4-lb.			2,209	7,905	10,114
	1-lb.			1,081		1,081
	$\frac{1}{2}$ -lb.			28,682	24,015	52,697
	$\frac{1}{4}$ -lb.			228,395	162,758	391,153
	$\frac{1}{4}$ -lb. (96 to case)			18,023	39,442	57,465
	$\frac{1}{8}$ -lb. (96 to case)			30		30
Yellowtail	1-lb.			651		651
	$\frac{1}{2}$ -lb.			516	301	817
	$\frac{1}{4}$ -lb.			386	526	912
					3,928	3,928
Totals		14,943	1,646,185	2,175,325	595,045	4,431,498

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1928

(Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries.)

Salted, Smoked and Dried

Species of fish	Size or quantity	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Anchovies.....	2½-lb. cans (12 to case).....		32			32
Anchovies, salted.....	10-lb. kits.....	95				95
	25-lb. kits.....		13			13
	280-lb. bbls.....		29			29
Bismarck herrings.....	10-lb. pails.....	460				460
Herrings, smoked.....	Pounds.....	28,110				28,110
Mackerel, salted.....	10-lb. kits.....	3,020				3,020
Mackerel, smoked.....	Pounds.....			23,192		23,192
Mixed fish, dried.....	Pounds.....	114,459				114,459
Mixed fish, salted.....	Pounds.....				258,143	258,143
Rollmops.....	10 lb. kits.....	675				675
Sablefish, smoked.....	Pounds.....	110,193				110,193
Salacchini.....	10-lb. cases.....		325			325
	50-lb. cases.....		4,155			4,155
	100-lb. cases.....		50			50
Salmon, mild cured.....	Tierces.....	1,874				1,874
Salmon, salted.....	Pounds.....	4,380				4,380
Salmon, smoked.....	Pounds.....	46,125				46,125
Sardines, salted.....	25-lb. kits.....		1,156			1,156
	50-lb. bbls.....		78			78
	100-lb. bbls.....		43			43
	280-lb. bbls.....		201			201
Sardines, smoked.....	Pounds.....	20,202				20,202
Sardines, sirloins.....	8-oz. jars (24 to case).....		98			98
Shad, mild cured.....	Tierces.....	196				196
Shad, smoked.....	Pounds.....	5,000				5,000
Shrimps, dried.....	Pounds.....	85,918				85,918
Squid, dried.....	Pounds.....		154,600			154,600
Miscellaneous Data						
Fish flour.....	Tons.....		525			525
Fish meal.....	Tons.....	220	12,355	12,923	2,367	27,865
Fish oil.....	Gallons.....	11,847	2,444,869	1,268,518	24,068	3,749,302
Estimated value of pack.....		\$708,415	\$7,712,747	\$12,263,151	\$3,894,543	\$24,578,856
Number of employees.....		432	1,898	3,090	1,289	6,709
Value of packing plants.....		\$1,075,420	\$2,369,400	\$4,865,891	\$1,117,175	\$9,427,886
Number of plants.....		27	15	18	8	68

NOTE.—Sardines packed and fish meal and oil produced at Pittsburg included with Monterey.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1929

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt----	Mendocino, Sonoma, Lake-----	Marin-----	Solano, Yolo-----	Sacramento, San Joaquin--	Alameda, Contra Costa--	San Francisco, San Mateo--	Santa Cruz-----	Monterey-----
Anchovies-----									4,580
Barracuda-----									
Bonito-----								51	
Carp-----				6,299	13,405	5,684			
Catfish-----		32,760		1,624	36,771	18,319			
Cultus Cod-----	17,252	78,805					179,634	17,819	55,547
Eels-----					14	413	10	87	123
Flounders-----	8,277	17,580					119,541		50,685
Grayfish-----							172,303		21
Hake-----							300		
Halibut-----	163,618	12,879			25,957		13,025	93	5,819
Hardhead-----									
Herring-----	30,693		274,602			14,350	424,750	375	18,533
Kingfish-----							1,127	11,276	198,290
Mackerel-----									1,646
Mackerel—Horse-----									
Mullet-----									
Perch-----	28,048	238					270		7,681
Pike-----			36,522			48			
Pompano-----				115	253	1,025			33
Rock Bass-----									
Rockfish-----	54,763	27,071					325,004	111,219	366,741
Sablefish-----	29,968	977					134,775	154,669	15,848
Salmon-----				1,009	2,656	1,642			
Sardines-----		10,170							524
Sardines-----			75				133,826		98,089,455
Sculpin-----							5,375,483	12	60
Sea Bass—Black-----								120	
Sea Bass—White-----									801
Shad-----				16	40	226			
Shad—Buck-----				7,033	1,926	16,236			

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1929—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into San Pedro.	Fish from south of the International Boundary brought into San Diego.	Total from south of the International Boundary brought into California.
Anchovies		17,337			21,897	404,581	40,303	444,884
Barracuda		287,199	540	3,604	291,343	46,606	3,727	50,333
Bonito		6,274	9	2,493	8,827			
Carp					25,448			
Catfish					89,474			
Cultus Cod			244		349,301			
Eels					10			
Flounders		752	14		146,801			
Grayfish		26,352	84	24,290	273,714	33		33
Hake					321			
Halibut	60,577	115,530	16,192	67,236	454,969	38	22,911	22,949
Hardhead					25,957			
Herring	305	84,955	430	346	745,421			
Kingfish		5,239,901	415,475	852,499	117,317			
Mackerel	2,143	105,875	30		6,703,308			
Mackerel—Horse		1,150	133	748	107,551	5,338		5,338
Mullet		34,288	405	10	2,031	13,749	5,037	18,786
Perch	3,070				110,580	214		214
Pike					1,393			
Pompano		291			1,324	16,867	958	17,825
Rock Bass	2,309	10,908	28,281	6,212	47,710	16,389	27,319	27,708
Rockfish	42,620	521,997	1,587	468,223	1,919,225	1,606	24,762	26,368
Sablefish	70	861			337,168			
Salmon					5,307			
Sandaks		2,476	26		197,022			
Sardines		155,907,635		2,440,693	261,813,353			
Scupin		13,790		15,036	31,818			
Sea Bass—Black	20	9,053	2,812	15,036	34,837	13,706	61,270	74,976
Sea Bass—White		118,889	982	24,282	131,122	10,339	21,482	31,821
Shad			10,357	1,095	25,245			
Shad—Buck								

Shad—Roe.....	902	92,470	132	7,807	19,618	239	3,366	3,005
Sheepshead.....		9,080	964	3,247	101,311			
Skates.....					149,029			
Skipjack.....						67,172	704,256	771,408
Smelt.....	16,899	98,459	874	7,049	203,973	567		567
Sole.....	35,211	4,611	1,766	6,695	3,060,861			
Solittail.....					5,655			
Striped Bass.....					90,081			
Suckers.....					393			
Swordfish.....					170			
Toncod.....					3,997			
Tuna—Yellowfin.....		244	10		937,476		3,184,315	4,121,791
Turbot.....					138			
Whitebait.....					58,167			
Whitefish.....	145	26,361	19	30,474	4,131		5,673	9,804
Yellowtail.....		884		3,082	56,999	43,323	130,045	173,368
Miscellaneous.....		15,573	586		214,208	1,694	16,084	17,778
Total fish.....	164,271	162,753,175	481,952	3,965,687	277,987,356	1,568,068	4,251,488	5,819,556
Crustaceans:								
Crabs.....					7749,904			
Shrimps.....					348,813			
Spiny Lobsters.....	14,387	32,150	5,483	31,030	83,050		662,357	662,357
Mollusks:								
Abalone.....	2,048				369,263			
Clams—Cockle.....					18,237			
Clams—Mixed.....					6,971			
Clams—Pismo.....					91,770			
Clams—Softshell.....	27,552				34,285			
Cuttlefish.....					6,831			
Oysters—Eastern.....					9100,086			
Squid.....		87,572			172,935			
Totals.....	208,558	162,872,897	487,435	3,996,717	279,909,451	1,568,068	4,913,845	6,481,913

* 31,246 dozen.
 * 454,935 shell oysters.

